The Builder.

VOL. LIV No. 2345. SATURDAY, JANUARY 14, 1888.

ILLUSTRATIONS.

New Board Schools, Beverley-road, Hull.—Messrs. Botterill, Son, & Bilson, Architects ..... *Double-Page Ink-Photo.*
Some English Brasses.—From Rubbings taken by Mr. A. Oliver, A.R.I.B.A. ..... *Double-Page Photo-Litho.*
Church of St. Candida, Whitechurch Canonicorum, Dorset.—Drawn by Mr. H. W. Brewer ..... *Single-Page Photo-Litho.*
Manor House, Ockwells, near Maidenhead.—Drawn by Mr. R. W. Paul ..... *Single-Page Photo-Litho.*
City Churches by Wren: now Destroyed.—From Drawings by Mr. W. Niven ..... *Two Single-Page Photo-Litho's.*

Blocks in Text.

Riddlesden Hall, Yorkshire.—Sketched by Mr. Alfred Whitehead ..... *Page* 26
Details of Mouldings, Church of St. Candida, Whitechurch Canonicorum 28
Plan showing Sites of City Churches 29

CONTENTS.

Granite Quarrying 19
Notes 22
A Seventeenth-Century Almanack 24
Architects considered as Scapegoats 25
Riddlesden Hall 26
The Empire Theatre and its Site 26
Competitions 27
New Board Schools, Beverley-road, Hull 27
Some Old English Brasses 27
St. Candida, Whitechurch Canonicorum 27
Manor-House, Ockwells, Berkshire 28
City Churches, now Destroyed 28
Brasses of the Fourteenth and Fifteenth Centuries 30
Obituary 32
The Architectural Association 32
The Sphere in Perspective 33
Account-keeping for Architects and Surveyors 33
The Student's Column: Iron 33
Recent Patents 33
Recent Sales of Property 34
Meetings 34
Miscellanea 34
Preferential Railway Rates on Foreign Produce 34
Prices Current of Materials 35

Granite Quarrying.

IT is surprising that the methods employed in quarrying and blasting granite are in such a backward state in many districts. The cost of producing the material is considerably influenced by the manner in which it is quarried and subsequently manipulated, but exceedingly few quarry-owners have given attention to the progress of science in regard to the disposition of joints and other phenomena bearing on the relation of granite to its surrounding rocks, which are of the first importance in opening quarries. The method of blasting is also susceptible of much improvement.

Our granites, by reason of their hard nature, usually stand up as boldly-defined hills out of the surrounding country; therefore nearly all the quarries are situated at a considerable elevation. In selecting a site on which to open a quarry much attention is directed to the observation of the run, size, and condition of the blocks of granite, or "heathens" as they are often termed, which usually strew the surface of the ground along the sides and tops of the hills. The nature of the overburden, which in most cases is very rotten, decomposed granite, is also taken into account, and in some districts it is considered that when the overburden is brownish and loamy, or containing much clay, it is a favourable sign that good granite exists underneath it, but when the decomposed material is very sandy it is unfavourable.

Now these preliminary considerations are very well as far as they go, but we believe that other matters, which are commonly neglected, are far more important. We have met many instances in which the stone is of first-rate quality, and in sufficiently large blocks, which is all the above preliminary examination of the ground provides for, but the expenses in working the quarry are considerably augmented by the circumstances that it has been opened too near the top of the hill, or driven in the wrong direction into it. In the former case a tremendous amount of haulage and crane-work, consequent on deepening the quarry, is entailed, whereas if it had been opened lower down the hill the level of the floor of the quarry could have been preserved by driving the head of the workings into the hill, and this extra haulage would have been unnecessary. In the latter case we more particularly refer to those districts in which the jointing of the granite is tolerably regular, and, therefore, in which the general directions of the main joints can be predicted.

Occasionally one sees a splendid face of rock in a portion of a quarry which has been deserted solely on account of the danger in quarrying produced by the high inclination of the joints towards the working, and down which the blocks may, without warning, suddenly slip on the workmen. It is obvious that when the general directions of the main joints are ascertainable, such a contingency may easily be avoided by a little foresight. It seems desirable, therefore, to determine, if possible, the positions of the joints in the hill. In regard to the granite quarries of Cornwall this, in the majority of instances, could be easily done. There appear to be three sets of main joints which hold good on all the large granite areas in the county, the first running approximately east and west, the second north and south, and the third disposed in a more or less arch-shaped manner and governed by local circumstances. The first two series are very regular in their main directions, but becoming, in the Penryn and Penzance districts, more north-east and south-west, and north-west and south-east respectively. In other words, the east and west joints follow the direction of the axis of the county and the others at right angles to it. The amount of their inclination, if any, is easily ascertained, and is wonderfully persistent for miles, quarry after quarry exhibiting similar features.

As might be imagined from our description, it is the third great series of joints which, in being variable in position according to local circumstances, should be more particularly considered. A very little knowledge concerning them, however, suffices to determine their position at any particular place. From observations in the quarries one sees that they in most, if not all, cases have materially assisted in giving the present outlines and contours to the hills and valleys. That is to say, the atmospheric agencies in weathering or carving the outlines of the hills have been largely guided in their work by taking advantage of the weaknesses caused by theae joints. When these bedding joints are dome-shaped the hills they form are also dome-shaped; and when they are elongated, having an axis or back, the hill is also elongated, having an anticlinal-like structure, but dipping not only from either side of the axis downwards, but at both ends also. From this it will be seen that the granite quarries opened at the summits of the hills exhibit horizontally-bedded joints, whilst in those opened on the sides of hills, these joints will be more or less inclined, according to the amount of inclination of the outline of the hill at each locality. In some cases the bedding joints are so highly inclined as to cause the outlines of the hills to be very steep. It will be found, however, that the sides of the hills in such cases are rather more inclined than are the bedding planes, so that in practice it is well to assume that the bedding joints are more horizontally disposed than the outline of the hill indicates; and the steeper the hill, the greater will be the correction to be applied. The only exception to this rule is where a river has cut its way through the granite, and the ordinary atmospheric weathering has, therefore, been so much assisted by erosion as to cause the slopes of its valley to bear little or no relation to the bedding joints of the granite. Fortunately, however, this very seldom happens.

To open a granite quarry is an expensive operation, and it is well worth while to study some of these points before commencing. They lead us to perceive that when a large quarry is to be made on the side of a hill it is better to commence,—where the bedding joints are so disposed,—by working obliquely into it, leaving a broad slightly-inclined platform behind, than to drive right into the hill at once, leaving only a narrow entrance to the quarry. The inclined joints can then be approached sideways, and the danger of removing the blocks is thus reduced to a minimum. That side of the driving towards the centre of the hill might be left at as low an angle as the joints conveniently permitted. The reason we think that a broad entrance should be effected is because we have seen so many cases where by leaving only a narrow one the quarrymen have been considerably "hampered." For instance, the face of the quarry may "run sandy," and give other indications of an unfavourable nature, whereby they would have to abandon the working in that direction. The only resource left in such a case is to deepen the quarry, and here considerable expense is often incurred. Besides the extra power required for lifting the granite from great depths, the confined nature of the space (unless the quarry be a very large one indeed) not only produces difficulty in blasting, entailing much waste, but a greater quantity of explosive material is required until a large face is made. When there is only a narrow entrance the machinery, roads, lines, &c., both leading to and from the quarry, are made with reference to it, and the quarrymen exhibit the greatest reluctance in interfering with this usual line of route. When the entrance is broad, like a platform, however, or where there is no definite entrance, the face being open to the country around, the greatest latitude

might be allowed. The men are no longer confined to one narrow exit and entrance to send the stone in and out, they can easily extend blasting operations to any part of the platform, whilst it is open to them to recommence on the outside of the quarry, driving another platform at a lower level, the old platform being then at the top of the working and gradually removed as the face of the lower platform advances. Thus they may be enabled to alter their system and to continue the working by successive platforms. An objection might be urged that the platform system could also be adopted when only a narrow entrance had been made by simply working the sides of such entrance and levelling the whole to the outside of the hill; or by re-commencing outside and driving obliquely parallel to the narrow entrance. In theory this, of course, could be done, but in practice it would in most cases fail, and for this reason. In the progress of the development of the quarry a considerable amount of waste is necessarily entailed, and is a great source of expense in working. Now, it is a maxim of human nature not to expend more money on what is seemingly useless work, than we can possibly help, so we find that the average quarryman in removing this waste from the scene of operations never takes it farther than the first convenient place where it can be tipped, and such a place is generally found on the slopes of the hill on either side of the entrance. These tipped rubbish-heaps are frequently of such magnitude as to form conspicuous objects for miles around. It follows, therefore, that if it is desired to drive a platform at a lower level this waste would have to be moved again, which is such an expensive process as to be rarely done, and so if working is still to be continued there is no alternative but to deepen the quarry. Of course, if such a contingency had been provided for it would have been another matter, and in most cases it could, no doubt, be done by forming the waste heaps not on either side of the entrance, but on the hill slopes at the lateral extremities of the working, where the waste could often be deposited just as cheaply.

It is evident, however, that the method to be adopted would vary with the locality, but still the principle would remain the same. The "waste," when the quarry is situated near a large town, is generally disposed of for rough ashlar work, walling, &c.; thus, other things being equal, the quarry should be opened as near a town as practicable, the sale of "waste" being decidedly profitable.

We have hitherto assumed that the extent of ground capable of being worked upon is unlimited. It sometimes happens, however, that the quarrying limits are much confined, so that in development the working must of necessity be deepened.

Again, supposing a quarry has been badly opened, or where from any other cause its limits become circumscribed, and it must be deepened, it would seem advisable for the quarrymaster to carefully consider the method by which it is to be carried out, with reference to placing cranes most advantageously. Shifting steam-cranes is expensive work. Wherever possible "blondins" should be erected, whereby the waste and smaller blocks can be cheaply raised from the floor of the quarry to the surface of the ground instead of employing large cranes for this purpose. We have been astonished in the course of our visits to several large quarries in the kingdom to find that not only were "blondins" not at work, but that the men in charge had never heard of such machines.

Our remarks hitherto respecting joints in granite have been more particularly in reference to the Cornwall and Devon districts, and although the same principle of opening a quarry applies equally to any granite district, yet we may mention that the extreme regularity over a wide area in which the joints occur is almost peculiar to that part of England. The other tracts in which granite quarries are situated are usually governed much more locally in regard to disposition of joints, and, therefore, of the method of opening them up. For an example of an important district in which the jointing is less regular, and which preferentially might be regarded as the normal type, we may instance that of Aberdeen. In going into any quarry in this district, a glance suffices to show that, no matter how impersistent the jointing may be over that tract generally, the leading joints are clearly distinguishable, and can usually be relied upon. They seem to be disposed in a definable manner for short distances, and so the quarrymen are quite as capable of predicting the lie of the rock as are those in the other areas alluded to. The principal difference is that the quarrying is not such easy work, the triangular and rhomboidal shapes offering much resistance to blasting until a large face has been made. The minor joints, moreover, in some of them have a great tendency to "run tight" in a most provoking manner, requiring considerable skill to quarry without wasting much material,—which is the essence of the work. From what we could see, it does not seem very difficult to predict the directions of leading joints before opening a quarry, though it may not be done with such facility as in Cornwall and Devon. We believe, moreover, that by systematic observation with clinometer and compass the chaos which now appears to exist in regard to prevalent directions of joints would be reduced to order. Certain it is that some are traceable for considerable distances, and that close observation on many sites suitable for quarrying would reveal their position at each place.

We have alluded to the fact that elvans are sometimes found in blasting granite. Now, an elvan, from a geological point of view, is nothing more nor less than a mass of rock which has been injected into the granite in a molten condition, when the latter was more or less consolidated. The injection has often followed along one or another of the leading joints, which was opened to receive it. The elvans are intimately associated with mineral lodes in Cornwall, the main directions of both being practically the same, the lodes in a great measure having also formed in joints and fissures. In every granite tract, veins and dykes of injected igneous matter are found, being also known under the comprehensive name of trap or greenstone.

From a practical point of view the effect on the granite of all these igneous injections and mineral lodes is nearly the same. It will be easily seen that in the case of the former, the action of the heated injected matter has a tendency to bake, and otherwise alter the homogeneity of the granite at the contact, and at varying distances from it. The jointing is usually also in much disorder in the immediate vicinity. In the case of the mineral lodes, a great deal depends on local circumstances in the lode itself; for instance, in metal mining, it is sometimes found that the granite in which the lodes are situated is impregnated for some distance with the same metal as occurs in the fissures, and the miners' definition of a lode embraces portions of the granite walls of the fissure where this is the case. They work the impregnated granite, if it is worth it, just as they do the contents of the fissure itself, to obtain the metal. On the other hand, the lode is quite as often entirely restricted to the fissure, though the granite walls are nearly always altered in some way. This alteration may be beneficial, or otherwise, as far as the commercial value of the granite is concerned, but it is mostly otherwise. Our readers will distinctly understand that a very great number of lodes contain no mineral matter of sufficient importance to be of commercial value, and are therefore unworked.

The principal effect of the alteration of lodes on granite is that they may change its colour about the junction. We know of at least one case in a quarry where the grain of the stone was made coarser, and rendered much harder than the normal rock; but this is very local, the granite being usually made rotten and disordered.

The direction of lodes, veins, dykes, elvans, barrs, &c., may with care be traced over the surface of the ground before opening a quarry. We should decidedly not advocate the making one near any of these agents of alteration, though, of course, it is sometimes unavoidable. Large sums of money have been lost by the abandonment of quarries on account of the disorganised jointing and discolouration produced by them. With abundant capital, however, the difficulty may often be surmounted.

Another element, of a much wider application in considering sites for granite quarries, is the proximity or otherwise of metamorphic rocks, such as slates, schists, &c. The alteration which these rocks have undergone has frequently been produced by the mechanical and chemical effects resulting from the proximity of masses of granite when in a highly-heated condition. Indeed, many geologists believe that the granite is merely the result of extreme alteration of these rocks, the heat generated having been sufficient to melt them, and that they formed granite on solidification. It has been shown that there is a gradual passage from certain metamorphic rocks into granite, but it is very difficult to demonstrate the fact, owing to the paucity of continuous sections. Moreover, we believe that the perception of this passage has been much interfered with by the irruptive nature of the granite, which tended to eat its way through surrounding rocks, thus often absorbing the materials which would have shown us the intermediate stages. In going over granite tracts it is found that the rock, as a rule, is considerably disjointed and discoloured at and near the junction of metamorphic rocks, and the amount of such alteration will be governed by the character of the transitional intermediate stages alluded to. If the granite has been very irruptive, and absorbed a large portion of the transitional beds, it may be brought somewhat abruptly against the metamorphic rock, when the belt of alteration in the granite would be very narrow, and quarries could be opened tolerably near the junction. But when this is not the case, the belt of alteration is wider, and in order to avoid opening them in a rock which might be highly foliated,—the minerals having a tendency to form in layers,—it is necessary to give it a wide berth, commencing some distance from the junction. Even then it is frequently found that the normal mineralogical condition of the granite is considerably affected by the addition of several minerals and fragments of the metamorphic rock, which may not only be prejudicial to its durability, but render the material quite unfit for the market. Nothing appears much worse to the artistic eye than the large black patches and stains often produced by the mineral schorl, which is found so abundantly near the junction alluded to. It is well, therefore, to closely examine the "heathens" to see that they do not exhibit much foliation, or contain large crystals of that lustrous black mineral, schorl.

Leaving the purely geological side of the question, we will now consider the methods adopted in different quarries in boring and blasting the granite, and here we find that there is yet much to learn. In the first place the position of the hole for blasting, the probable effects of the blast, and the state in which that portion of the quarry will be left (in regard to future quarrying) after the blast has taken place, must all be carefully deliberated. Disregard of any of these points leads to waste expenditure, and is a sign of bad quarrying.

Commencing with the position of the hole, it may be stated that individual experience is almost the quarryman's sole guide as to where it should be made, and with this there is little fault to find, although theoretically it is a doubful mode of procedure. Some prefer to place the hole within a foot or so of the joint from which a mass is to be thrown out, and causing it to end within a few inches of the underlying bedding joint; whilst others, when the positions of the blocks are favourable, bore the hole down the joint itself. The latter method, although necessitating the use of great quantities of explosive, may in emergencies be resorted to, inasmuch as the excessive use of the explosive may be more than compensated by the expedition resulting from it. It is not at at all times practicable, however, to bore the hole in the joint. The overhanging rock often gets into the way, whilst the discolouration

always found along a joint compels the blocks to be masoned rather more than is frequently found necessary by the former method; but a great deal would depend on circumstances, and that is the reason, we believe, that in this instance the quarryman's experience is the best available guide.

One of the principal things to be observed is that the blast should not take place on a rising bed, but, if possible, on a horizontal or outwardly inclined bed, along which the mass may be moved without the expenditure of much more force than is necessary to merely give the blocks motion. If the blasting has to move the mass up a rising bed, or inclined plane, not only will a much greater quantity of explosive have to be used, but the blocks underlying the mass intended to be moved will in many cases also be shattered, fractured, and, it may be, rendered unsaleable. But if due precaution be taken in the first opening of the quarry such untoward events will not often happen.

In some of the districts of Cornwall the phenomena locally pronounced "pedniamaen" occasionally leads to blasting on a rising bed, it being a case where a joint runs irregularly. This, of course, cannot be helped, and experienced quarrymen soon get over it. Phenomena of a similar nature occur frequently in the Aberdeen district, in such quarries as usually exhibit tolerably regular beds.

The blast-hole itself is either made with a steel bar having a chisel-shaped end, by hand, or with a steam rock-drill. Each method has its advantages and disadvantages. In regard to the former, three men are commonly employed in boring the hole,—one sitting and keeping the bar in position, the other two standing and striking it with hammers. If the bar, as we have described it, is used, in spite of the fact that it is a round-shaped implement, the resulting hole will be triangular. This shaped hole is much preferred by many quarrymen, because, as they say, the explosive is guided in its effect by the sides of the hole, and it is frequently found that the direction of cracks in blasting have been so determined. This result, on the face of it, is reasonable enough, and such a hole may advantageously be used for shallow borings, say, not over 4 ft. in depth. But when we come to the making of holes of more than that depth (as is the case in the majority of blasts), triangularly-shaped holes should on no account be made, for the following reasons: The sides of the triangle gradually shift round, as the hole, in being bored, gets deeper, so that in a hole, say 12 ft. deep, it becomes considerably twisted (like the grooves in a rifle-barrel), and the sides consequently are no longer in the same position as when nearer the top of the hole. From this it will be seen that in order to take advantage of such a bore in blasting, it should be possible to calculate the position of the sides of the triangle at given depths; to be sure that the workmen in boring the hole always shift the bar round at a certain rate in a given depth of rock; and to be clear that the hardness and homogeneity of the granite is capable of being ascertained beforehand. We have heard of quarrymen who can do all this, but have never met one; and, as far as observation permits us to judge, we believe that the positions of the sides of deep holes are left to chance. If they approximately coincide with the lines of least resistance, so much the better, but if not,—well, when the blast takes place, the granite is cracked in undesirable directions, much of it is wasted, the blast generally may be regarded as a failure, and the quarryman deplores his "bad luck." This is the result of urging the explosive to take effect in directions not suited to the mass of rock and its joints by running counter to the lines of least resistance. For great depths, therefore, we would advocate the use of round holes, which may easily be made by having a steel collar attached to the bar. Round holes have no tendency to determine the direction of cracks in blasting; the explosive is free to act and to find its way along the lines of least resistance, as it should be able to do. In this way it is much easier to predict the direction of leading cracks, from surrounding circumstances.

The steam rock drill is gradually superseding the hand-bars in boring blast-holes in quarries where steam power is employed. When in position it does its work very much quicker than the latter. One of the principal objects with the drill is that it should be made as portable as possible, from the fact that it must be so frequently moved about from place to place; the loss of time on this account and the concomitant expense may otherwise considerably minimise its value in quarrying operations. Some of the latest pattern drills seem to fulfil this requirement, and are much to be preferred to the old-fashioned hand-boring implements.

We have stated that a blast hole may either be made down a joint or in the solid granite. The latter method is commonly adopted, the hole being usually made perpendicularly. When large it is known in some districts as a "muckle." Certain treatises on blasting point out that the direction of the blast-hole should be governed by the peculiar circumstances of each case. For example, it is stated that when the face of rock to be blasted is much inclined, the hole should not be made perpendicularly, but inclined in the same manner, otherwise a greater quantity of explosive is required to do the work, whilst much of the effect of the blast may be lost in finding its way up the bore-hole. Theoretically, of course, this is quite correct, and might do very well when blasting, on the flat, a homogeneous mass of rock with no joints; or where the importance of everything else was subordinate. In practice it is much more difficult to bore a slanting hole by hand than a perpendicular one, and a considerable amount of extra time is thus absorbed. But perhaps the most forcible objections that could be urged against the slanting holes are that a large quantity of granite is wasted, and the mason's work rendered heavier. In boring holes perpendicularly, when the beds are on the flat, the blocks are often roughly squared by the cracks in blasting, saving much masons' work; whereas slanting holes parallel to the face, when the beds are horizontally disposed, although blasting the rock with a less amount of explosive material cut it up irregularly, hence the waste and heavy masons' work to which we have adverted.

When the beds are not on the flat it may be advisable to expend a little extra by boring slanting holes in the manner indicated, especially if good steam rock-drills are close at hand; but in all cases of a free-blast the shape of the blocks required should be taken into account, other things being quite subservient.

Sometimes it is necessary to bore holes horizontally by reason of a joint running tight, or in order to relieve the work of a subsequent blast. These are termed "capping holes."

The explosive used in quarrying granite varies with the nature of the rock and the purpose for which it is required. If wanted for architectural or constructional engineering purposes the blocks have to be quarried as carefully as possible, and rock-blasting powder is employed. There can be no question of the superior advantage of using this explosive in all such cases. The cracks resulting from the blast are clean, and not too close together; whilst,—to use the quarrymen's term,—it heaves the rock out from the face of the working. The powder commonly employed is often deficient in nitre and much impregnated with foul salts. We would suggest that the grain of the powder should be much finer than that at present so generally used, and it should be of better quality. The effect of fine-grained powder appears to many quarrymen to be decidedly more satisfactory than that of the coarse-grained, and this no doubt results from the fact that it occupies less space in the bottom of the blast-hole, and the force of the explosion being thus more narrowly confined becomes proportionately more concentrated and efficaceous.

Speaking generally, quarrymen waste a large quantity of powder in blasting granite by underestimating its capabilities, as we have proved by repeated observation. The following fact may assist to explain this point. We happened to be in one of the most extensive quarries in the kingdom not long since watching the *modus operandi* of blasting; an intelligent foreman of considerable practical experience superintended. It was a case where a previous blast had not "heaved" a large portion of a granite block far enough from the face of the working by reason of a joint having caused much trouble, so the object was to move it farther out. The quarryman looked at the size of the block to be removed and the nature of the case and then ordered a man to fetch 25 lb. of powder from the magazine to do the work. The man having returned, under the foreman's direction, proceeded to pour the powder down the crack. When this was partially done a little delay was caused by the foreman debating with himself as to whether he should use the 25 lb. or 20 lb. Subsequently he directed the man to use only 20 lb. The blast took place and was highly satisfactory in every way, and then it was discovered that by some error in measuring out only 16 lb. of powder had actually been used. We believe that the work could have been excellently done with 10 lb. of the same explosive.

All quarrymen are not so wasteful, perhaps, and those very few who buy their own explosives, or who really understand the subject, are probably the most careful. In many quarries where blasts take place daily the money squandered on account of waste powder must be considerable.

Before pouring the powder down a blast-hole, the latter is carefully dried out, the mud being brought up by an implement made of a hollow cylinder, with a valve at the base and open on top, being fastened to a wooden rod. When it is desired to use this implement, it is put down the hole, and the mud forces its way through the valve into the cylinder. It is then drawn up, the valve closes, and the mud is brought with it. After this operation has been repeated, and the hole made fairly dry, powdered dust is sprinkled down the hole, finishing the operation. If the hole be too wet to admit of the explosive being put in "naked," a sort of rough cartridge is manufactured of brown paper, covered with pitch. In the case of a "capping hole," the rock-powder is placed in a scoop, which is pushed into the hole, and half turned round when it has reached the extremity, when the powder is turned out, and securely lodged in the desired place. This, of course, is a very primitive method, but is quite in keeping with the general order of things. The better class of quarrymen, however, use proper cartridges.

We have hitherto confined our attention to the blasting of granite for the construction of buildings, piers, embankments, breakwaters, &c., and have advocated the use of fine-grained rock-powder therefor. But the material is quarried for divers other purposes, common ones being the production of road-metal and pitching, when powder should not be used.

The principal object in quarrying for road-metal is not only to produce a large effect, but to cut the stone up as much as possible without materially injuring its substance. Dynamite is found to be one of the best explosives for this purpose, as it shatters the rock in all directions. Galleries and drift-ways are also constructed in suitable positions to assist the operation. Occasionally, blocks for road-metal, after being dislodged from their original positions, are brought to the floor of the workings and "shotted,"—further split up into pieces. We should also use dynamite, or some such explosive, for getting rid of a run of bad blocks, or in the removal of an obstructing elvan, vein, or lode, in the quarry.

The kind of fuse commonly employed in igniting the powder is known as the "patent safety fuse." It consists of a cylinder of gunpowder inclosed in two separate folds of hempen cord, which are successively wound round it in reverse directions, the outer one being varnished to keep out the damp. There can be no doubt of the efficacy of this fuse: misfires rarely happen. The usual method of applying it is to take two lengths tied in a knot, and then let down the hole when about half the powder is poured in. The other ends of the fuse are then secured, in order that they shall not slip down the hole. When

firing, both ends of the fuse are lighted, to make doubly sure of igniting the powder.

In some quarries the powder is ignited by electricity. The fuse is composed of two insulated copper wires, the naked ends of which are connected by a thin thread of platinum and inserted in some exceedingly fine-grained powder. The fuse is applied as before or made up into a cartridge. On firing, a spark generated in the thread of platinum ignites the surrounding explosive, which, in its turn, communicates with the blasting-powder, and the result is instantaneous.

In regard to the respective merits of these fuses it is hard to judge, but we incline towards the electric for the following reasons. When the powder has burned down the patent fuse the two small holes resultant therefrom necessarily place the blasting powder in direct communication with the outside air, so that when the blast takes place, unless under the most favourable circumstances, a certain amount of the force of the explosive will be lost by escaping up these holes. In using the electric fuse described no such lines of weakness are produced, and, other things being equal, the full force of the powder is expended in doing its proper work. At the same time the patent fuse may be safely employed, being cheap and almost certain in its result. The electric fuse should always be used in those operations where a blast requires more than one hole, because all the holes can be fired simultaneously,—a great advantage.

When a misfire happens, after a reasonable time has elapsed water is introduced into the hole, the charge is thoroughly wetted, and then withdrawn.

We now come to a subject which demands the most careful consideration of those interested in quarrying granite, namely, the nature of the material employed in filling up the blast-holes above the powder, and technically known as the "tamping." The aim of the tamping should be to obtain the greatest possible resistance to the charge of powder; perfection would be arrived at if it could be made as strong as the surrounding rock. The material commonly employed is dry quarry refuse, or decomposed rock pounded up, but it is very questionable whether this is the most desirable. The quartz crystals may strike fire, and by prematurely igniting the powder cause accidents. Moreover, the sharp crystals alluded to are apt to sever the fuse, which is one of the reasons why two lengths of fuse are employed: if one should be cut the other may remain intact. Of course, if a wire of the electric fuse were severed in a similar manner, the charge would be spoiled. But there is yet another reason why tamping should not be made of the ordinary quarry refuse: it does not afford such an effectual resistance to the charge of powder as is possible to be obtained. Fine, dry, loose sand is sometimes employed, and is equally inefficient.

As the result of direct and protracted experiment, it is found that the best material for tamping, consistent with economy, is clay, not in a wet plastic state, but well dried before a fire, in clods; it should be rammed down the hole in lumps. Yet only on three occasions have we ever seen this material used in granite quarries, and in two of these the lumps were too small, and much of the effectiveness lost.

The "tamping bar" may be made of wood with a copper or Muntz metal ram at the end. Steel bars strike fire on the quartz, and it is highly dangerous to use them in tamping just over the powder. We do not believe in plugs or wedges being inserted in the top of the blast-hole above the tamping. They do very well in experimenting to prove that increased resistance is thereby obtained; but if the tamping is good, the advantage derived in this respect is not compensated by the extra expense incurred. After the explosion they are usually lost or battered in such a manner as to be rendered useless for future blasts, or are so firmly fixed in the hole that they become troublesome to remove.

Let us hope that the time will soon come when, by perfecting and economising our methods of quarrying and manipulating granite, this splendid material may be brought into the market at such prices as will effectually enable us to compete with the foreigners who have obtained such a firm footing in the market.

NOTES.

A NEW French publication under the title *L'Architecture* appeared on January 7th, constituting the "Journal Hebdomadaire" of the "Société Centrale des Architectes" of France. The Société had hitherto only its *Bulletin Mensuel* for forming a medium of communication with the profession, and it has long felt the want of an organ placing the managing body more directly and intimately in connexion not only with its own members but with all who are interested in the art of building. The journal is published under the management of a committee nominated by the Société, one of whose duties is to discourage any too direct personal attacks against individuals or their designs. The journal is sent to all members of the Société Centrale, who are considered as "abonnés du droit," and this privilege is extended to all French and foreign Architectural Societies with which it has any relations, and the Société engages an editor out of its funds, so that the journal is started on in an exceedingly public spirit. The first number contains a good deal of various information concerning current architectural events in France, and two good illustrations (external perspective and detail) of M. Hénard's building for the "Caserne des Sapeurs-Pompiers," of which mention has been made in one of our "Letters from Paris." The number also includes a very lively little essay by M. Chas. Garnier on the position of the architectural profession regarded in the light of scapegoats ("Les Boucs Émissaires"), which we have given in another column.

MR. J. ROMILLY ALLEN has lately called the attention of the British Archæological Association, and, inferentially, of all British antiquaries, to the great need of a museum of Christian archæology for Great Britain. He complains, and with justice, that the two important classes into which native antiquities divide themselves, viz., Pagan and Christian, are scarcely ever adopted in public museums, although the branch of archæology which deserves the attention of Englishmen and Christians, before all others, is that which deals with the remains of the Christian period in this country. It would, indeed, be difficult for the curators and keepers of our museums to reply satisfactorily to Mr. Allen's powerful interrogatory,—Why have the museums taken no steps to set apart a special gallery for the reception of objects illustrative of our national Christian art, and is there any likelihood of this ever being done by the responsible authorities? It is not for want of material, for the well-known works of Dr. Stuart, Professor Westwood and O'Neill record at least two hundred inscribed stones, and double that number of ornamented crosses, belonging to the ante-Norman period alone, in Great Britain and Ireland; but the South Kensington Museum contains casts of four only, and those are mixed with specimens from Scandinavia! Well may Mr. Allen complain that his endeavour to awaken the authorities of that Institution to a due sense of their imperfections resulted in nothing but unsatisfactory correspondence. Mr. Allen finds at the British Museum the tin ingots stamped with the Chi-Rho monogram of Christ set out side by side with Roman burial-urns, Celtic bells, and Persian bronzes. The conclusion is, that if a museum of the character described is to be formed, it should be independent of those already in existence, and he thinks that if the value of such a museum were properly understood some generous donor would come forward with funds before it is too late to save the relics of our early native Christian art. The educational value of such a collection of casts as might now be brought into one body would be undoubtedly great, and we shall only be expressing a widely-felt sentiment if we wish Mr. Allen good-speed with his undertaking. If the Government would but give a small annual grant for a few years, to be devoted to the furtherance of this object by taking photographs and casts, and if the City of London, for example, would find a site for a small museum at the Guildhall or on any piece of vacant ground in the City, the work thus happily inaugurated would be sure to prosper, and the study of the materials thus gathered and intelligently arranged would stimulate observation and exert a special and valuable influence on our knowledge of the past; for here, as in other cases, history is best taught by its own monuments, religion by its own symbolism, and art by its own masterpieces.

THE quantity of coal won in the United Kingdom in the year 1886 is returned at 157,518,482 tons, which is a slight reduction on the 159,351,418 tons of 1885. The highest yield was attained in 1883, and was 163,737,327. This slight but perceptible decline affords a striking contrast to the prospect of continued geometric increase in demand which led to the coal panic of fifteen years ago, and the accompanying great rise in price. The average output per *employé* per annum in 1886 was 302 tons; that in Belgium being at the same time 171 tons, and that in France 176. But the English coal is valued at the miserably low figure of 4s. 10½d. per ton, against 6s. 7d. per ton in Belgium, and 9s. 10d. per ton in France. The value in the United States is 6s. 1½d. per ton. And yet the industry of our colliers in 1886 has been almost at its maximum, having only been exceeded, as measured by output, in 1869, 1870, and 1871, when each man won 312, 321, and 318 tons respectively. The lowest yield of which we have a note was in 1876, when it was only 249 tons per man; the total output of that year being almost identical with that of 1878, when each man raised 275 tons. Comparing these data, it must be confessed that this enormous industry is very little above starvation point. What royalty can be drawn by the coal owner out of a price of 4s. 10½d. per ton it is difficult to say, and considering the large capital invested in mines and machinery, it is evident that the miner in this country must be hard pressed in the battle for life. That we should be supplying our rivals in manufactures with upwards of 24,000,000 tons of this prime article of necessity at from 25 to 50 per cent. less than they can raise it from their own mines is one of those points as to which the industrial classes are now beginning to see that some rational investigation of the propriety is loudly demanded.

OUR contemporary, *Fair Play*, states that the traffic on the Maine has increased to such an extent since the canalisation of that river that a proposal for deepening the channel is now under consideration. The traffic is now twelve times as much as it was in 1885. In that year no coals arrived at Frankfort-on-Maine by water, whereas between April 1 and November 1, 1887, the coal shipped amounted to 2,500,000, while the coal traffic on the railways sank during the same period from 5,500,000 to 1,500,000. We give the figures comparatively, as we are not quite sure what measure our contemporary indicates by the letters ctr. It is probably the German centner, of 50 kilogrammes or 110·23 lb. avoirdupois; in which case, the saving in freight by transport in ships, which is stated at 25 pf. per ctr., will be about 4s. 8d. per ton. Since 1885, the transport of cereals has increased from 24,000 to 430,000 by ship, and has sunk from 800,000 to 360,000 by railway.

A RECENT report of the Foreign Office, No. 75 of "Reports on Subjects of General and Commercial Interest," gives some interesting information on the subject of the practice of bricklaying in frosty weather in Norway. Several paragraphs which have appeared from time to time in our columns have made it apparent that in some portions of Europe building in frost is not considered

so sinful or impossible a matter as it commonly is in England; and the special report referred to, which is addressed by Consul-General Michell to Lord Salisbury from Christiana, goes to confirm these statements. Mr. Michell's attention seems to have been aroused by the fact that building went on in winter and summer alike in Christiana, and his report is mainly based on inquiries made by him from M. Paul Due, an architect of eminence in Christiana, who has carried out many buildings through frosty weather. Several public buildings in the city are mentioned as having been built or partially built in winter, and having stood remarkably well; and the report gives the *modus operandi*, as follows:—

"In the use of unslaked lime lies the whole art of executing bricklayers' work in frosty weather. The mortar prepared with it is made in small quantities immediately before being used, and the proportion of such lime is increased (together with the expense of building) as the thermometer falls. Warmth being developed by the use of unslaked lime, it is only a question of utilising it so handily and quickly as to enable the mortar to bind with the bricks before it cools.

Another very important condition in the execution of such work in winter is that the bricks should always be kept covered on the building site. Bricks which have been out in the rain or exposed to the frost should never be used.

The upper courses of bricks that have been laid are not, as a rule, covered with planks or mats for the night. That precaution is adopted when the work has to be suspended for a certain time, and when it, therefore, becomes necessary to prevent rain from penetrating the brickwork, which would otherwise be destroyed by the action of frost.

When no such covering is used, it is absolutely necessary, after a fall of rain or snow (and after the suspension of work on Saturdays), to see that all snow or ice is removed from the walls before the work with warm lime is resumed. Otherwise, the warmth of the lime would be absorbed by the snow or ice. The removal is effected by means of spades and brooms, but the fire of a brazier is frequently used for the purpose."

A London architect writing to us on the subject, puts the question, "Is the work in Norway so subject as it is in England to be soaked with rain before freezing?" That is a pertinent question, as, by the admission of the report, exposure of the wall or the bricks to rain is a difficulty under the circumstances. But the report is worth reading, and Consul Michell has our thanks for calling attention to the subject.

THE ominous fact of a death-rate of 35 in the thousand seems to have roused Newcastle to a serious consideration of her sanitary condition; or at least the *Newcastle Daily Leader*, a spirited journal, appears to wish to lead its constituency in that direction. The *Leader* has brought a Special Commissioner to the rescue, whose name is not given, but whom we happen to know to be one of the leading sanitary ngineers of the day, and whose "speech ebewrayeth him,'—in any case, in the report in the *Leader* of the 7th of this month. The Special Commissioner's report is divided under four heads:—(1) sewage disposal; (2) condition of existing sewers; (3) sanitary condition of the houses; and (4) water supply. The report is a very damnatory one on all heads, and fully accounts for the death-rate of Newcastle. The main sewers all discharge into the Tyne at about mean tide, and are tide-locked for half the tide; the sewage is discharged without any treatment of any kind. The main sewers are old brick ones, well constructed originally, but subject to defects from displacement of the brickwork in places, and from not being enough examined and cleansed in those parts which are too small for the easy passage of a man. These are, however, being taken up each year as far as funds permit and relaid with pipe drains under the direction of the City Engineer. The sanitary condition of the houses appears to constitute the worst term of the indictment. We can hardly do justice to this without quoting part of the Commissioner's report:—

"We commenced our inspection at the Cock Entry in Pilgrim-street. This court was in a disgraceful condition, ashes and filth lying indiscriminately about it. It apparently has been seldom visited by the city scavengers. Thence we went to Clayton's-court, Pilgrim-street, where the same want of attention by the sanitary inspector was most obvious. The two water-closets in use were completely choked up and their contents were overflowing. It was so also with the large ashpit, which had to serve for the use of all the inhabitants of the court. From there we went to a house in Silver-street. Here the water-closet, which was inside the house and in proximity to the living-rooms, was devoid of all ventilation, and was as filthy as the accumulated dirt of many weeks could make it. Filth reigned everywhere. . . . . Silver-street itself was in a most disgraceful condition, the whole length of it presenting the appearance of one common ashpit. We then ascended a yard in Dog Bank called Cain's-yard, which may be described simply as an accumulated heap of dirt and rubbish. The closets and receptacles of garbage were in a condition festering with corruption, and all the floor gullies designed for the purpose of carrying off surface water were broken, and practically useless.

The whole length of the street in Dog Bank presented a most disgusting sight, it being covered with human excreta, as were also the steps leading to Church-walk. The stench in both these cases was absolutely unbearable."

The water-supply, though not coming from the best kind of source (the contributing source being pasture land), is reported as fairly good and plentiful. The summary of the Commissioner's Report is that the insanitary condition of Newcastle is more due to neglect by the Sanitary Inspectors, and want of proper scavenging, than to any fault on the part of the City Engineer or his staff: a conclusion which arises naturally out of the statements of the report. The *Newcastle Leader* is highly to be commended for its public spirit in taking the matter up, and we can say authoritatively that their Commissioner is one whose skill and knowledge of the subject may be relied on.

A PROSPECTUS is issued of the Upper Trent Navigation Company, with a share capital of 250,000*l.*, for the purpose of restoring the navigation of the river between Burton-on-Trent and Wilden Ferry, the point of junction with the Trent and Mersey Canal system. The scheme was brought before Parliament last year, when its rejection, on technical legal grounds alone, was obtained by the landowners, whose opposition was entirely regardless of the public interest, and was chiefly founded, as far as appeared in the evidence, on the fears that trout would go higher up the river, or into the Dove, to spawn, if navigation of the Trent was restored. As a good water communication between Birmingham and Hull may be established for a moderate cost, if the present block on twenty miles of one of our finest water-ways is removed, it is desirable that the public should be made aware of the nature of the opposition to one of the greatest benefits that can be conferred on the communication of Birmingham with the sea.

THE greatly increased building activity in Berlin gives rise to the apprehension that another great crisis, such as was experienced shortly after the Franco-German war, is approaching. In the centre of the city a large number of old private dwelling-houses have been transformed into hotels, warehouses, and offices, so that the stranger who has not seen Berlin for some years is surprised at the improvements made in the fronts of the houses. But the change has its disadvantageous side. The prices which have been paid for building sites have risen in some instances to 20,000 and 30,000 marks (1,000*l.* and 1,500*l.*) per square rod. By this transformation of the centre of the city, the inhabitants have been driven to its periphery. It is the activity in building operations in the outskirts, and especially in the western suburbs, which causes apprehensions. The new building law for Berlin, with its more stringent requirements of air and light, came into operation on September 24th last for the districts of Charlottenburg and Teltow. The speculating builder has displayed an almost feverish activity in order to utilise his sites in accordance with the old building laws. He has concentrated his energies almost exclusively upon more ambitious residences,—that is to say, such of from six to twelve rooms,—and the market for houses containing them has become glutted, whilst a positive scarcity of smaller dwellings is making itself felt.

THE *Deutsche Bauzeitung* publishes a paper by the Government architect, Reinhardt, on the removal of the remains of the piers of the Roman bridge over the Rhine at Mainz. There were remains of fourteen piers, resting upon piles from 9¾ in. to 15½ in. in diameter. The space between the piles was filled up with rubble and woodwork, upon which the masonry rested direct. Each pier was protected by a solid stone batter against the effects of water or ice. In removing the piles divers were employed, who worked in air caissons. The wood removed was in a good state of preservation, being attacked only from ¾ in. to 1·17 in. deep. In the wet state it was not very heavy, but difficult to work after drying, on account of its great hardness. There is a great divergence of opinion with regard to the time of the construction of the bridge; but Dr. Velke places it about the time of the Emperor Domitian (A.D. 90), when it was probably built by the Fourteenth Legion.

THE following statement in regard to the London College of Architecture, to which we have before referred, appears in the last number of the *Journal of Proceedings* of the Institute of Architects:—

"Among the exceptional opportunities offered to architectural students at the present day, may be cited the recent establishment of a college at 46, Great Ormond-street, London. The curriculum of this College of Architecture is a comprehensive one, divided into three sections, headed respectively: Scientific, Artistic, and Professional Practice. The first includes mathematics and mechanics, geometry, stereotomy, surveying, geology, physics, and building construction; the second, the history of architecture, drawing, designing, and modelling; and the third a most complete course of the strictly practical and legal subjects necessary to a modern architect. There are three terms in the year, the hours of attendance being from 10 a.m. to 5 p.m. daily, except Saturdays, when the college is closed; and convenient arrangements have been made for occasional day or evening students, to enable those whose time is partially occupied to partake of the advantages afforded by the college. A Correspondence Department has also been established for country students; and arrangements have been made for a limited number to board and reside with some of the masters. The Directors are Messrs. A. Hessell Tiltman and W. Henry Wood, *Associates*, and they are assisted by qualified assistants. Mr. Wood is a Royal Academy silver medallist, and well known through his practical work in connexion with the classes of the Architectural Association, especially the Class of Construction, to which he has been secretary, a visitor, and chairman respectively, for three sessions; and many students already owe much to his skilful teaching and advice. Mr. A. Hessell Tiltman has been nine years in practice, during which time he has designed and carried out important works, both public and private, in various parts of the country. He was also for some time Lecturer on Architecture, Engineering, and Surveying, at the School of Estate Management, Deanyers (Hants), and has received most satisfactory testimonials from the principal of that Institution. Many members of the profession, whom he has prepared for the Royal Academy Schools, have testified to his ability; and in a recent competition for one of the representative professorships in London, Mr. Tiltman was among the selected candidates. As [a draughtsman and designer, the Institute has had several opportunities of appreciating Mr. Tiltman's work; and one subject, of which he has made a special study, "Practical Perspective," was ably treated by him in a series of articles which appeared, in 1886, in a journal devoted to building and engineering interests. The directors state that the primary object of the college is to systematically prepare students for the Architectural Examination, and in order to effect this purpose thoroughly, every attention has been paid to the published suggestions and advice. The complete course of study occupies three years. It is considered, however, that those attending the lectures, &c., of the college for one year would be thoroughly well fitted to enter an architect's office for the usual articles; those remaining two years would probably be accepted as improvers; and those completing the full term would be competent to accept engagements as junior assistants, fitted to derive the fullest benefit from seeing work carried out, and to obtain practical experience of office routine. The directors, who appear to offer every inducement to their students to join the ranks of both the Institute and the Architectural Association as early as possible, have fortunately obtained for the college premises some of the studios lately vacated by the Royal Institute of Water-Colour Painters, together with the use of a very valuable collection of casts, &c. At the desire of several architects who are taking fresh pupils, an arrangement has been come to whereby the directors accept responsibilities for the personal instruction of pupils upon special terms."

A CORRESPONDENT writes:—"The variety of occupations referred to by your correspondent 'Viator,' in last week's *Builder*, is not, by very far, a solitary instance of the curious opinion entertained by certain persons as to what really constitute the duties and qualifications of an architect. Here are two advertisements appearing now in papers having a respectable circulation:—

MR. ———, Architect and Surveyor. Plans and Specifications. Architecture in all its branches. Collector to the Soup Kitchen and Bread Society.

MR. ———, Architect and Surveyor. To be Sold, cheap, a good Second-hand Shop-front.

IN the recent Apprentice's Exhibition at the People's Palace, which closed last Saturday, there was one feature of some interest which we have not alluded to, viz., a combined set of furniture for a room, executed among the classes in the technical schools there. The exhibition of such room designs is, of course, a common thing now; but the point in this case was that Mr. Jacob, the instructor of the cabinet-making class, suggested to the students a co-operation in one design of this kind instead of merely exhibiting specimens of handiwork in a scrap form. The idea was taken up with alacrity by the students, who found a new interest in the execution of details which were to contribute to a complete whole. The drawing class and modelling class contributed to the work, as well as the cabinet-making class. The furniture was designed by Mr. Jacob, and was in very good taste. A similar combination of work might with advantage be carried further in a future exhibition of the same kind. The list of evening classes of the Technical Schools in connexion with the Palace is a very long one, including education in a great variety of trades and studies. Among the subjects specially connected with building work are classes for plumbing, cabinet-making, metal turning, carpentry, wood carving, handrail work, electrical engineering, &c.

MR. CLEMENT HEATON'S "Cloisonné-Mosaic," some specimens of which have been on view at Messrs. Dowdeswell's, in New Bond-street, is a fine decorative process, which ought to receive attention from architects. The name is rather misleading, as there is nothing in it of mosaic as usually understood, as the building up of a design in small cubes of self-coloured material. It is really cloisonné-enamel on a large scale, but with a filling composed of fine marble powder bound into a hard composition by a medium of oleo-resinous matter and wax, which is put in soft and hardens naturally without passing through a furnace. The constructive base is of metal, with brass cloisons soldered on; and the general appearance is that of a marble inlay with the colours surrounded and defined, as in cloisonné-enamel, by the thin light lines of the cloisons. It is, of course, much more tractable and less costly to execute than marble inlay, and appears likely to be permanent and durable. The cost varies a good deal in proportion to the elaboration of detail and the amount of the cloison lines, which form the chief element in the cost. A figure in Mediæval style, somewhat resembling a stained-glass design, cost for the working about 2*l.* per foot. The invention is an important novelty in decorative processes, and those who are interested in work of that class would do well to inspect the examples at Messrs. Dowdeswell's. They can be sent out of the studio complete and ready for fixing, and can be removed bodily when required.

WE are glad to see that Sir F. Leighton has been elected a member of the Royal Society of Painters in Water-colours. We hope this will lead to a new element of interest in the Society's already always good exhibitions.

Association of Municipal and Sanitary Engineers and Surveyors. — Under the auspices of this Association, voluntary pass examinations for candidates for the offices of Municipal and Local Board Engineers and Surveyors will be held at the Institution of Civil Engineers, Great George-street, Westminster, in April next.

A SEVENTEENTH-CENTURY ALMANACK.

AT a time when people are taking into use their new almanacks and diaries, it may not be without interest to look through the pages of a very early example of that kind of publication. It lies before us now, in a brown parchment cover, written over in various characters, stained with all sorts of stains, worn quite through to the printed leaves in places,—not by fair wear and tear, but by ill-usage,—for, not many years ago, this dog's-eared old volume, printed in its unintelligible type, was regarded as of no worth as a book, and not of much good to put under a table-leg to steady it. But times have changed for it now, and probably none of its numerous owners have looked on it with greater affection than does its present possessor.

The title-page is gone, as well as a leaf or two at the end, so that we do not know who was the author,—for author he was, and not merely a compiler, as your almanack-maker is now-a-days. Neither do we know the exact title and date. But as every page is headed "A Concordancie of Yeares," we may take that to be the name of the book; and from internal evidence it must have been published in 1612 or 1613. The last remaining page is numbered 228,—so the author has a good deal to say; but how different from the information to be found in the almanacks of to-day! There is, of course, the kalendar; then follows a vast deal of matter astronomical, astrological, and medical; then weights and measures; fairs in England and Wales; the value of gold; a table of precedency; a list of the peerage; information ecclesiastical and geographical; and, to conclude, a table of notable events from the Conquest down to 1611, when the record breaks off.

All these things are of interest to the antiquary, as throwing the light of a contemporary mind on the popular ideas and beliefs of that period. The astronomical matter, for instance, is interesting, and serves to explain many allusions to be found in writers of that time as well as to give the original meaning of various phrases which are in use in the present day,—such as "the music of the spheres," "quintessence," "the heavens," "the elements," and so forth. The astrological matter is highly entertaining and is intimately joined with the matter medical; for no cure might then be attempted unless the stars were favourable. Indeed, a large part of the book is devoted to this branch of the subject, and the nature of the advice offered shall presently be shown by various extracts.

But let us glance through the pages a little more carefully. From the very outset we have this astrological jargon, in which the signs of the zodiac and the names of the planets play the chief part. At the head of each page of the kalendar, for instance, is a note of the qualities of the zodiacal signs, regarded from a medical point of view, thus:—"Aries is of the East, Masculine, Fiery, and Cholericke. Governeth the Head, Face, Eyes, and Ears, &c. and sicknesses, the Apoplexie, Mummia, Spots, Abortisements, Ring-wormes, and Morphewes," &c. After this we are not surprised to learn that Taurus governs the "squinances"; Virgo, "opilations of the Spleene"; and Sagittarius, such a sickness as "Falls from high places and from horses." And we welcome the little diagram that follows the kalendar, setting forth (in the words of the book) "The Anatomy of mans Body, as the parts thereof are governed by the 12. Signes of the Zodiaque."

The kalender finished, our author proceeds to explain the formation and nature of the universe and all that therein is, and the way in which he classifies things is not a little entertaining. "There are three orders of Creatures: corporal, as the Elements; spiritual, as Angels; and compound, as Man. Corporal bodies are subdivided into bright and shining bodies, as planets and stars, or into opacious and grosse bodies, as the earth and metals, or into diaphane and transparent bodies, as aire and water." A scientific method such as this manifestly gives scope for a great deal of amusement, and accordingly every page furnishes matter to nourish a most humorous sadness in the reader. "The world," according to our author, "is divided into two parts or regions, Elementary and Aethereall. The Elementary part is subject unto daily alteration, and doth contain the Fire, Aire, Water, and Earth. The Aethereall region doth contain in his concavity the Elementary region, and this Aethereall region is called of some *Quinta Essentia*, the quintessence or fifth substance, which is a body of itself . . . . containing no contrariety, and being without corruption." Here, then, we have the original meaning of quintessence, which has gradually come to be used to denote the finest and most volatile part of any substance.

"In the Elemental part of the world [we read further] is contained the earth, the water, aire, and fire, the superficiall convexity of every one of these resting in the superficiall concavity of the next superiour element: and therefore the earth hangeth in the concavity of the water: the water in the concavity of the aire, and the aire in the concavity of the fire, even as you see the scales of onions one inclosed in the other." Nothing could be more definite than this, and before you have time to ask how the fire is supported, you find that the earth is "a round body like unto a ball, darke and solid without any concavity, hanging by the providence of God, fixed in the middle of the world, insomuch that if you were in any other part of the earth, you should be no neerer unto ye heavens then if you are in England." The heavens themselves are described in a subsequent chapter, which throws light upon various terms that have long ceased to be understanded of the people.

"The celestiall part of the world [we continue our extracts] called of some *the Aethereall Region*, or *Quinta Essenti*, encompasseth and containeth in the concavity thereof all the *Elementall Region*. And this celestiall part hath in it ye seven Planets, & their spheares, the starry Firmament, the Christalline Heaven, the First Mover, and the Emperiall Heaven." The Emperiall Heaven, we then learn, is the foundation of the world: it is immovable, most fine and pure in substance, most round in shape, most great in quantity, most clear in quality, and most high in place. It contains, besides (as it is thought) the humanity of Jesus Christ, three Hierarchies, each of which has in it three orders. The first, or supercelestial, contains Seraphins, Cherubins, and Thrones; the second, or celestial, contains Principalities, Powers, and Dominations; the third, or subcelestial, contains Vertues, Archangels, and Angels, and, "to conclude, here is the abundance of all goodnesse, and perfect felicity with the privation of all evill."

Next within the Emperial Heaven is the first mover, or *primum mobile*, containing all the inferior spheres, and carrying them with it in its movement, which is from east to west and to the east again in twenty-four hours. To understand the system of astronomy here described, it is necessary to recollect that these arrangements of spheres were made in order to account for the movements of the heavenly bodies from the stand-point of an observer placed in what was supposed to be the centre of the whole system, namely, the earth. Outside the earth and the other elements came a further layer of the onion, transparent, and a great many miles thick: this contained a planet, and was called its sphere: outside this came another sphere with its planet; and so on till the seven planets were accounted for. Then came the starry heaven, containing all the stars beyond the seven planets; and then the christalline heaven, which was introduced to account for variations in the revolutions of the heavenly bodies observed over a long period.* Outside this, again, was the *primum mobile;* and then the emperial heaven, surrounding and enveloping all. Into all the minutiæ of this system we need not now enter; but very full particulars are given in this almanack, including "the course, colour, placing, magnitude, and distances of the seven planets, with the thickness of their spheres," "the magnitude of the sunne and moone, and the rest of the planets, with their diameters and distances from the earth in miles, according to Tycho Brahe; and the magnitude of the fixed starres and other secrets concerning them." We further learn of "the six great Circles in heaven and the twelve signes; of the four lesser circles in heaven; of time; of days, weeks, and months, of the lunar year, the solar year, and the Julian year; as

* Milton, in spite of his friendship for and appreciation of Galileo, has many allusions to this old astronomical scheme; *e.g.*, "Paradise Lost," Book III., speaking of the fate of those who did not attain after death to the gate of Heaven:—

"They pass the planets seven, and pass the fixed,
And that crystalline sphere whose balance weighs
The trepidation talked, and that first moved"—&c.

well as of kalends, nones, &c.," and what they be.

All this information, clear and explicit as it is, may be regarded as of a general or abstract nature. But in Chapter xxiii. our author descends to the concrete and matter-of-fact subject of "the infortunate and fatall days of the yeare, as also of the good and happy dayes." This was a branch of his subject likely to interest all of his readers, many of whom might not care to accompany him in his flights to those astronomical altitudes. His information is precise enough. Without any circumlocution he begins,—"January the 1, 2, 4, 5, 10, 15, 17, 19," and so on; "Aprill the 16 and 21. Not so evill the 7, 8, 10, 20," &c. After tabulating a large portion of the year thus, he proceeds to state that "in every moon there be two other infortunate daies"; and not content with this, he adds five more up and down the year, and then mentions yet two more in every moon more particularly fatal, which were alwaies so accounted by the Romans, and noted in their kalenders. These twenty-four days, the most deadly of all, he does not openly specify, but, "to satisfie all," bids the perplexed reader to "take them in the following verses," and then gives four terrible Latin lines, that no human memory could retain, and subjoins an elaborate method of extracting from this gibberish the number of the day, and the hour thereof, which is "vehemently to be suspected"; but, for our own part, we hold it would be more comfortable to perish in ignorance than seek salvation by such a tortuous path.

After this the reader feels resigned to hear that the dog-days are to be added to the long, black list, as well as the 28th of December; and he even smiles at the virtuous wrath of his instructor in rejecting some additional days which a rival wizard would include among the infortunates. "There be other daies," says our sage, "recounted in a little foolish booke, called the 'Booke of Knowledge,' which since their errours is apparent, they be better omitted then repeated." Here one might think he would be content to rest, having rendered about one-third of the year miserable; but not so, for he adds: "And you must note that there be other daies infortunate and evill, caused by the motions of the starres and planets, and by the aspect of the moone to the rest of the 6 planets, as in the ensuing table is compendiously to be seen." Then follows the table, and in its little divisions are given sententious pieces of advice, as thus:—"An infortunate day: journey not to princes, converse not with old men, fly husbandmen and rural labourers"; or thus, "Combe thy haire, seek the love of women, set thy children to schoole, put on new apparel"; or thus, "Poets be busy, make verses, exercise thy things witty. Let thy children goe to schoole." But not even yet has he done with his infortunate days, for they are further affected by the place of the moon in the heavens, which places are called "mansions," and are set out in another table, from which we learn that with the moon in her 8th mansion you should "journey, specially by water, take phisicke, best in pilles." The 14th mansion is not wholly prosperous; you may sow, plant, and take physic, but it is bad to journey, or marry a widow. The 19th, on the other hand, is a very useful mansion, as it is propitious if you want to "besiege a town, plant, sow, journey, or navigate." The 21st mansion affects architects more than others. It is propitious at the outset, but disappointing at the close; thus, "Lay foundations, build, sow, seek to Prince or Magistrate, marry not." But the most unhappy of all the mansions is the 26th, which is "a most fit day for physicke, in all other affairs bad." With this table our author mercifully holds his hand, for by this time the devout believer may well doubt whether life is worth living with so many "infortunate and fatall" days in the year, especially as, if he escapes by one table, he will probably be involved in some dire calamity by another.

The next two chapters are astrological. One tells you how "To finde what Planet doth reigne any hour in the yeare, and how long hee reigneth"; the other "of the natures and properties of the seven Planets." Then follow meteorological observations, as "a briefe discourse of the naturall causes of watery Meteors, as snow, haile, raine," &c. From this we learn, among other things, that earthquakes are caused "by plenty of windes gotten into the bowels, holes, and corners of the earth, bursting out of the earth." We are also told how to foretell the weather by the moon, by stars, by thunder and lightning, by clouds, by fires, by water, by fishes and fowls, four-footed beasts, wood, and stones. After this the seasons of the year are explained, and the months are taken *seriatim*, with weather forecasts for each in turn. Next comes much information, now best to be found in the early pages of the Prayer Book,—those antidotes to tedious sermons. We hear of the Golden Number, Circle of the Sunne, Dominicall Letter, and Epact; also, how "to finde the new or full moone more exactly by my new tables." Eclipses of the sun and moon come next; and then directions as to how to ascertain the movements of those planets lead us on to "Astronomical Elections for Physicke and Chirurgery, depending upon the place and course of the Moone." The amount of medical science displayed may be gathered from the opening words:—"If thy body be filled with naughty and superfluous humours, then were it convenient for thee to draw blood, so the heavens consent thereunto, and thy age agree therewith; which being not circumspectly weighed, it may be most dangerous to the Patient (of which no understanding man is ignorant) but when necessity urgeth, as for the *Pestilence, Plurisie, Phrenzy, &c.*; then, though the Heavens deny, yet a veine is speedily to be opened *ad ægri salutem*. This considered of medicines, some be purgative, some comfortive, and others in the mean betwixt both. Medicines purgative be either *Solvendo* or *Leniendo*. In the first the Moone must be in *Cancer, Scorpio*, or *Pisces*. For the other the moone must bee taken when she worketh more in moistnesse than drynesse," &c. These wise words are supplemented by rules for purging and for drawing of blood, and then by a kind of dietary, in which are given the meats good for various purposes, as "to beget choler, and dry up watery phlegme"; "to temper choler" or "to beget melancholy." The meats are specified which are good for the head, the heart, the stomach, eyes, liver, and lungs. All this information, medical and astronomical, is brought to a close by a chapter or two on the Moveable Feasts. When we consider how small a part of the year our philosopher has left us to enjoy ourselves in, and how he embitters even that remnant by hard rules of health, and expects his patients to temper their enthusiasm for physic with an intimate knowledge of the movements of the heavenly bodies, we may well thank our stars that our lot was not cast in those times.

Of the next chapter,—on Weights and Measures,—nothing much need be said, as it does not differ materially from what we can see for ourselves to-day; but the notes concerning "fuell" are worth transcribing:—"All fuell is sized by the statute, of which there be Shids, Billets, Fagots, and Coles: all shids must be foure foot long beside the carfe, and upon them is 1, 2, 3, 4, or 5 marks or notches, and then they must be in compasse about y^e^ midst 16, 23, 28, 33, or 38 inches, according as it hath number of markes."

"All Billets should be three foot long, and there be three kinds thereof, as the single, a cast, and a cast of two, the first being 7½ ynches about, the next 10, and the last 14 inches compasse."

"Fagots should be three foot long, and the band beside the knot 24 ynches made round; for your flat fagots be much lesse, though they be all one compasse about."

"The Sacke of Coles is 4 bushels."

Equally interesting is the table of the weight and value of several pieces of gold, as well as the reference to the proclamation for the restraint of the exportation of gold, dated the 23rd of November, 1611. The pieces then current were the Unite (22s.), Double Crown (11s.), Britain Crown (5s. 6d.), Thistle Crown (4s. 4d.), Half Crown (2s. 9d.), Rose Roial (33s.), Spur Roial (16s. 6d.), and Angell (11s.), and "the coin of gold of Scotland, called the 6*l.* piece" (11s.).

Chapter xlviii. contains a Table of Precedence and "The Nobility of England, according to their authority and degree, as they bee now living, 1611." The list contains the Marquis of Winchester, 25 Earls, 4 Vicecounts, and 54 Barons, and no more: a very different affair to Debrett! The contents of the last chapter of this diverting book are miscellaneous. It begins with a list of bishops, and after that gives a list of the shires, cities, and boroughs of England that have any knights or burgesses in the Parliament House. Cornwall is best represented, with 19 places; Wiltshire next with 16; then Yorkshire with 10, and then Sussex with 9; Lancashire has 6; Middlesex, 2.

Thus every page serves to emphasise the difference between those days and these. This difference is probably least visible in the list of the parish churches in each shire. Norfolk has most, having 660, Lincolnshire next with 630, and Suffolk next with 575; Westmoreland has fewest, boasting only twenty-six, which is twenty-one less than Rutland and two less than Flintshire. We once more plunge into the past in the "Geographicall Description of the Waies from one notable Towne to another, over all England, and thereby how to travell from any of them to the Citie of London"; or in the table of "Distance of divers other Citties out of England from the City of London," in which the public are supposed to be chiefly interested in the following foreign towns:—Virginia, Babylon, Jerusalem, Constantinople, Rome, Lisbon, Geneva, Dublin, Edenborough, and Paris.

The chronological table before mentioned brings this remarkable little book to a close. Both its interest and its amusement spring from the earnestness with which it is written, and from the serious way in which its wonderful science is expounded, and its marvellous methods of cure are set forth. We cannot do better than take leave of our author with the sentence with which he closes a list of the seven ages of the world, for it is not only characteristic of his style, but serves to fix the date of his labours. "The seventh Age beginneth at ye birth of Christ, and hath continued 1612 years at the 25 March, and so forth to the pleasure of God."

ARCHITECTS CONSIDERED AS SCAPEGOATS.

THE following is the text of M. Garnier's article in the new journal of the "Société Centrale des Architectes," referred to in another column. We give it in the original, as we are unwilling to spoil M. Garnier's piquant style by translation. It should be remembered that in France the architect's legal responsibility for failures is much more direct and definite than in England, and the French architects (to their honour be it said), when the subject has been occasionally discussed, have in the main come to the same conclusion with M. Garnier, to stand by their responsibilities:—

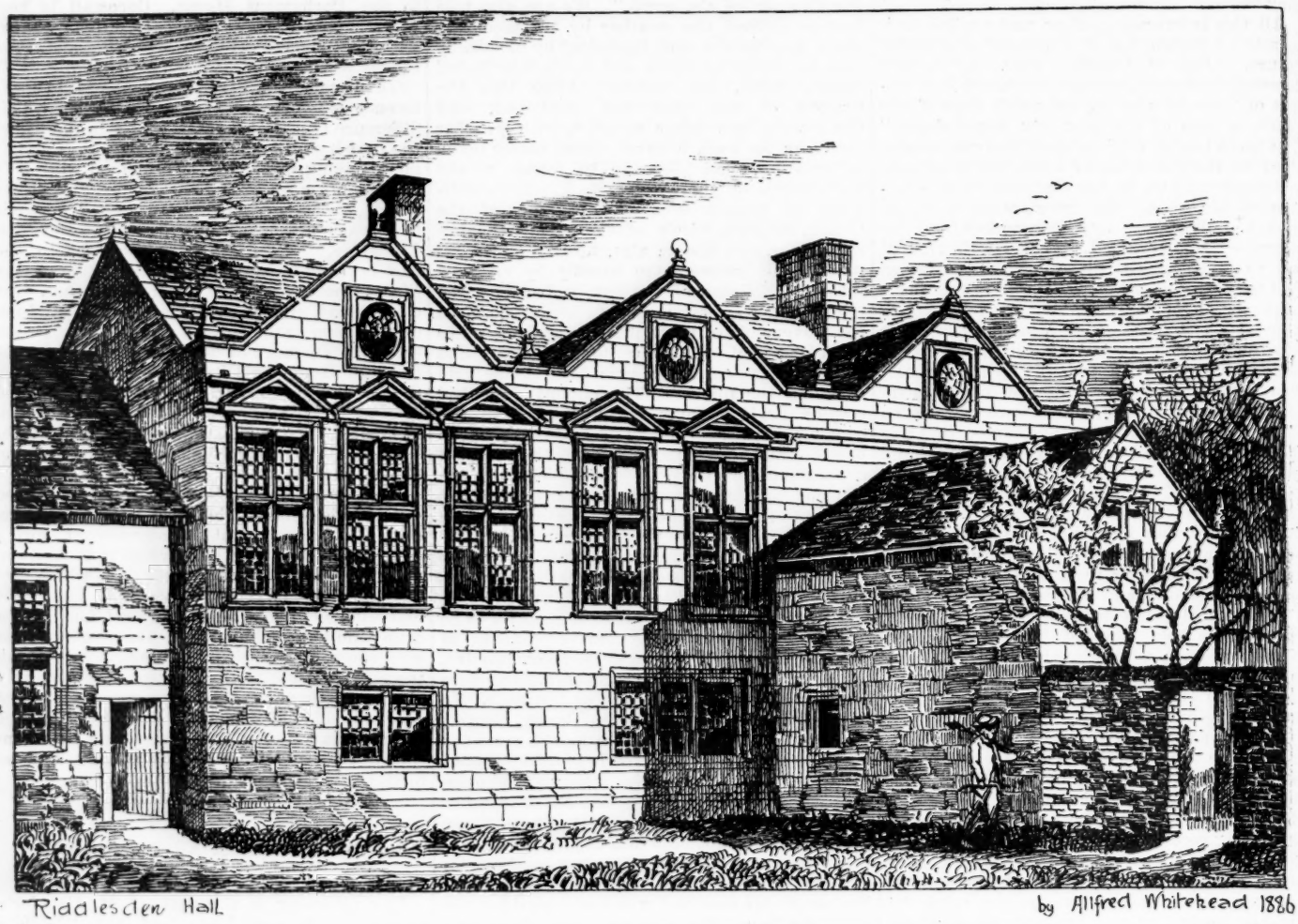
"LES BOUCS ÉMISSAIRES.

'Chez les Juifs, à la fête des Expiations, on amenait au grand prêtre un bouc, sur la tête duquel il étendait les mains et qu'il chargeait avec des imprécations de toutes les iniquités d'Israël. Les Juifs désignaient cet animal sous le nom d'*Azazel*, mot hébreu qui signifie *émissaire* ou *renvoyé*. Après cette cérémonie, le bouc était conduit sur les confins du désert et chassé au milieu des cris de tout un peuple. Le conducteur était obligé de se laver le corps et les vêtements avant de rentrer au milieu des siens.'

C'est ainsi que Larousse parle du bouc émissaire; les temps ont changé; les boucs ne sont plus voués aux malédictions des peuples; mais, comme il faut toujours que les passions humaines soient satisfaites, au lieu des boucs on a pris des architectes. J'ignore si les exécuteurs se purifient une fois leur besogne faite, j'inclinerais pourtant à le croire; car, dès qu'une bévue est commise, ils déclarent qu'ils s'en lavent les mains et qu'elle doit être attribuée à l'un de nous, bien heureux quand ils n'excommunient pas la corporation tout entière. N'est-ce pas naturel! c'est toujours le lapin qui a commencé.

Je m'en doutais déjà; car il est bien évident que c'est la faute des architectes si une mécanique va de travers, si les parlements ne votent pas les crédits que les ministres oublient de leur demander, que c'est leur faute si leurs devis sont coupés en deux, si les clients modifient leurs premières idées, si le feu prend aux bâtiments, si les rivières débordent, s'il pleut, s'il vente ou s'il grêle et si les affaires sont dans le marasme. Ah! nous sommes bien coupables! et nous devons faire bonne provision de *mea culpa*; nous aurons à les placer.

C'est un triste sort, n'est-ce pas, que de servir ainsi de cible à chacun? c'est une lugubre destinée que de s'endormir chaque soir



Riddlesden Hall by Allfred Whitehead 1886

en se demandant avec effroi qui, dans la journée, a fait une sottise que l'on doit endosser, demande bien inutile pourtant puisque ce sont les sottises de tous qui doivent nous incomber et que nous n'avons pas de choix à faire. Le maçon gâche mal son plâtre, le serrurier oublie de poser ses rivets, les ouvriers se mettent en grève et font monter les prix de série, et le client, qui a plus de confiance en son fournisseur qu'en nous-mêmes, bouleverse nos projets pour faire mettre un papier vert-pomme que lui recommande cet industriel; alors, comme c'est laid, c'est notre faute. C'est charmant!

Eh bien, voyez-vous, non seulement on s'habitue à cette petite vie-là, mais encore on en est enchanté et pas un d'entre nous ne voudrait voir décroître cette étonnante responsabilité.

Dame! c'est un brevet de force et de puissance qu'on nous décerne ainsi. Pour assumer sur nous tant de méfaits, pour collectionner tant de crimes, il faut bien que l'on suppose que nous avons le pouvoir de les commettre. Aussi voyez quel orgueil est le nôtre lorsque nous songeons à cette prépondérance. Et dire que quelques-uns, croyant-faire acte de justice, voudraient nous soulager de cette juste responsabilité! Quelle erreur! nous tenons à marcher toujours avec l'épée de Damoclès suspendue au-dessus de notre tête; le fil cassera peut-être bientôt; qu'importe? cette épée est le plus beau jour de notre vie! elle nous fait une diadème et, s'il est un peu pointu, il constate au moins notre souveraintcé. Renoncer à notre responsabilité! renoncer aux injustes reproches! ne plus agir dans le sens d'une légende consacrée! Allons donc! nous voulons garder intact notre droit, nous ne voulons découvrir personne, et, si un de nos chefs comme un de nos subordonnés fait une erreur, nous prenons cette erreur pour nous et la revendiquons largement et hautement. C'est notre puissance qui s'affirmé ainsi.

Je sais pourtant un directeur qui, lui, tient à ne pas abandonner son personnel; je lui en veux presque. Pourquoi sortir de la convention? pourquoi nous défend-il? il croit donc que l'équité ne toucherait pas à notre prestige, et que la suppression de circulaires flamboyantes nous rendrait la vie plus douce? Qu'ils s'arrête dans cette œuvre de philanthropie, qu'il nous laisse le privilege de rester les victimes expiatoires. C'est notre gloire, notre bien le plus précieux, celui qui nous place au-dessus des autres artistes, qui n'ont qu'à répondre de leurs œuvres propres; c'est ce qui fait de l'architecture le plus grand des arts, parce qu'il évolue au travers des persécutions. Vive Dieu! qu'on ne nous retire pas la couronne des martyrs! Si nous n'étions plus les victimes, on pourrait bien, avec quelque raison, nous traiter en bourreaux. Gardons donc le droit d'être toujours les boucs émissaires, et, vaillamment, fièrement, marchons avec cette responsabilité, qui nous permet de défendre tout le monde et de n'attaquer personne.

J'en connais plus d'un, en ce monde,
Qui ne saurait en dire autant.

CHARLES GARNIER."

RIDDLESDEN HALL.

THE illustration is taken from an interesting group of buildings picturesquely situated on a raised hillock overhanging the river Aire, about one mile from Keigthley station, and is an excellent specimen of the "old Yorkshire homesteads" of its period.

The residence comprises the "Old Hall," a sixteenth-century building, with very fine groups of deeply chamfered mullioned Tudor windows, with gables breaking up the roof line, and large open arched porch; this is connected by a low building consisting of kitchen, &c., with the "New Hall" (the subject of our illustration), an interesting example of seventeenth-century work, the upper rooms of which form one complete suite, the rooms on the ground-floor being used in connexion with the kitchen. These, with other blocks of outbuildings, including a fine old barn, are nicely grouped round an old fish-pond, forming a kind of quadrangle, which is entered by a pair of gates that still retain the old stone piers.

The whole buildings are in a very dilapidated condition, being let in several tenements, but they afford a capital sketching subject.

A. WHITEHEAD.

Messrs Musgrave & Co., Limited, of Ann-street Ironworks, Belfast, have just opened new offices and show-rooms at 40, Deansgate, Manchester.

THE EMPIRE THEATRE AND ITS SITE.

"Si j'avais eu à choisir le lieu de ma naissance, j'aurais choisi Leicester-square."—*Voltaire.*

THE opening of the Empire Palace, or Theatre of Varieties, on December 22nd last, completes another chapter in the history of Leicester-square. The theatre, it has been stated, occupies the site of old Leicester House; but this statement is scarcely correct. For Leicester House,—as built, *circa* 1635, for Robert Sidney, Earl of Leicester,—stood at the eastern end of the square's northern side, where are now the hotel, and Hammond's stay shop. It faced southwards, and lay some little distance back from the roadway, being separated therefrom by a coach-yard. It had two stories and an attic floor with rows of nine windows in elevation. In Sutton Nicholls's views of 1721 and 1754 will be seen a large house next adjoining to the wing, on the west, of Leicester House. This is Ailesbury, or Saville, House, town mansion of the Earls of Ailesbury, standing where the main front of the Empire Theatre is now, and within the lower liberty of St. Anne's, Soho, parish. Lord Leicester's house is popularly considered to have given its name to the space before it. Yet we are lately reminded that "in the Middle Ages" part of Soho-square was called La Doune, — a manor which, *temp.* Edward I., belonged to William of the Exchequer and Joan his wife, who claimed free warren thereabout; and that Leicester Field was "at the same date called Soka Leycester, it seems." *

Leicester House, then, abutted against the Military Yard or garden of Henry, Prince of Wales, afterwards used for Major Foubert's riding academy. According to the map which Richard Newcourt made in Charles I.'s reign and Faithorne engraved in 1658, it yet stood remote in open ground. Nor was it before 1670, say, that Leicester Field came to be quite surrounded by houses, and the interior space enclosed. At the same time we may point out that nearly all of the existing southern side, being in St. Martin's parish, forms a subsequent encroachment beyond the line of Green-street (*antiquè*, Dirty-lane), having been erected upon land belonging to Lord Salisbury. The association of the Salisburys with this district is com-

* *Teste* A. S. Ellis, *Notes and Queries*, Seventh Series, I., Feb. 20, 1886 (Placita de Quo. War., p. 478).

memorated by the names of Cranbourne-street, together with the now half-demolished Cecil-court, between Castle-street and St. Martin's-lane. When Sir Isaac Newton lived in St. Martin's-street his house there, which now has Long's-court by its northern side, overlooked the field. Moreover, the roadways into the square at the two northern corners are later improvements as devised in 1760. For many years the still yet remaining Sidney-place was the only out-way towards Coventry-street; in 1840 Cranbourne-street, hitherto an alley, was extended into Long-acre. By the year 1720, however, building had so far advanced that Strype could speak of the "very handsome, large square, enclosed with rails, and graced on all sides with good-built houses, well-inhabited and resorted unto by gentry, especially the side towards the north, where the houses are larger; amongst which is Leicester House, the seat of the Earl of Leicester, and the house adjoining to it, inhabited by the Earl of Aylesbury." The enclosure, by the way, was a favourite spot for duels; all readers of "The History of Henry Esmond" will remember that Lord Castlewood, having for his seconds Jack Westbury and Harry Esmond, is mortally wounded by Lord Mohun in Leicester-field, and carried to the surgeon Aimes's bath in Long-acre.

Leicester House, the early home, it may be, of Lady Dorothy, Waller's "Sacharissa," of Algernon Sidney, the patriot, and of Henry, the handsome Sidney of the De Gramont Memoirs, was built by their father Robert, second Earl of Leicester, upon the portion of Lammas land, by right of a previous grant to his ancestor Baron de L'Isle and Izes by Henry VIII., and for which he is known to have made certain yearly payments. Hatton, in "A New View of London" (1708), cites "Liecester House, on the Nly side of Liecester-square, a handsome brick building now in the occupation of the Imperial Ambassador, let to him by the Earl of Leicester." In his "Old and New London" Mr. Walford records that about one hundred years since the Sidney property here passed to the Tulk family for a sum of 90,000*l.*, and that in 1874 the representatives of that family conveyed their rights as to the enclosure for 13,000*l.* to Mr. Albert Grant, who made over the area to the Metropolitan Board of Works. In the dedication of his "Don Sebastian" to the Earl of Leicester, Dryden, writing from his home in Gerrard-street, Soho, styles himself a poor inhabitant of his lordship's suburbs, whose best prospect is in the garden of Leicester House. Having been, in Pennant's well-known phrase, "successively, the pouting place of princes," the house was pulled down about ninety years ago, Lisle-street having been built over the garden site in 1791. In searching through some of the rate-books belonging to St. Anne's, Soho, we find, under date 1691, the Earl Kingston, as next to Earl Leicester, rated to pay 3*l.* 12s. In 1693 this rate is charged, for the same house, to "Earl Aylesbury," that is to say, Thomas (Bruce) third Earl of Elgin and second Earl of Ailesbury. He it was who, whilst among the first to invite William of Orange over to England, as a mediator between the king and the people, peremptorily refused to countenance his accession to the throne, or to conform to the Government of the Revolution. He was committed to the Tower, but subsequently obtained leave of exile, and settled at Brussels. Thereupon, Ailesbury House was occupied by Peregrine, Marquis of Caermarthen, eldest son of Thomas (Osborne) first Duke of Leeds, who here entertained Peter the Great during his sojourn in England. Dying in November, 1741, Thomas, Earl of Ailesbury, was succeeded by his eldest son Charles, who married, for the first of his three wives, the Lady Anne Saville, eldest daughter and co-heir to William, Marquis of Halifax. About this time Saville House was thrown into communication with Leicester House, to accommodate the children of Frederick, Prince of Wales, who lived there during the period 1743–51. George III., as Prince of Wales, occupied the house now and then, and was proclaimed in front of it upon succeeding to the throne. In 1780, Saville House, being then in occupation of Sir George Saville, Bart., M.P., was attacked by the "No Popery" rioters, who sacked the mansion and burned its contents in the square below. Having been reconstructed, the eastern wing of the premises was tenanted by Miss Linwood, from 1800 to 1845, for the exhibition of her painfully-wrought pictures in needlework and crewel embroideries. Messrs. Christie & Manson sold her collection by auction, on the premises, on April 23, 1846, when less than 1,000*l.* were received for the laborious handiwork of sixty-five years. Here for a short while a Radical society, by name of the National Political Union, held its meetings. In 1849 the hall was hired for the exhibition of panoramas of views taken in New Zealand and along the river Mississippi. To these succeeded other shows and entertainments, which, being for the most part of the *tableau vivant* and *pose plastique* order, contributed not a little to the reputation that, until of late years, this neighbourhood enjoyed. Meanwhile the house's western portion had been used by a large mercery establishment, at this date represented by Messrs. Stagg & Mantle's. By a fire which broke out in 1865 the then "Eldorado" Music Hall, the eastern part of Saville House, was gutted to the ground-floor level. The outer wall remained for some years, bearing within our memory, in large gilt letters, the name of Saville House. The so-called Denmark theatre was next projected to occupy the site: next followed the equally abortive Alcazar Theatre. The ground was then cleared (1879) for a large circular building to receive the cycloramic show of Balaclava. That in its turn soon gave way to the Pandora, which, however, was ultimately converted into the Empire Theatre, after designs furnished by Mr. Thomas Verity, F.R.I.B.A., in the Moorish or Eastern style. Mr. Verity's theatre had been partially constructed when Messrs. J. & A. E. Bull were commissioned to complete the work, and the Empire Theatre was opened with a performance of Hervé's "Chilpéric" on April 17, 1884. Of the house in its present state (Messrs. Romaine-Walker & Tanner, architects) we gave a detailed account in our paper of Dec. 17, 1887.

COMPETITIONS.

New Barnet Public Hall.—For the Public Hall for New Barnet and district, for which competitive designs were sent in last month in reply to an advertisement, the premium has been awarded unanimously to the design signed "Pro Bono Publico," by Mr. F. Miller (London). The decision was made by the "Building Committee," but we are not informed whether the Committee called in any professional adviser; they undertook in their advertisement to do so "if they deem it necessary," which is not altogether putting it in the right way; one side of the question, at least, is whether the architects deem it necessary. A premium of 25*l.* was offered, but the Committee did not bind themselves to employ the author of the premiated design to carry out the work. We presume, however, that they will do so.

The Mozart Monument at Vienna.—Of the thirty-seven designs for the Vienna Mozart monument, exhibited at present in the large hall of the Künstlerhaus, the jury has awarded the first prize, by eleven votes to one, to Herr A. P. Wagner, Vienna, to whom the city is already indebted for several high-class works, such as the "Gänsemädchen" and the Michael Angelo of the Artists' House. Herr Wagner's monument is very simple. A black base supports the sitting figure of Mozart, and the projections of the base have on one side a lion and on the other a sphinx, each with a standing muse. Professor Rudolf Weyr has received the second prize, awarded unanimously. His Mozart stands erect without mantle by the side of a music stand, upon which the composer rests one arm, whilst the right foot seems to beat time. The figure is supported on a short round capital, rising over a richly decorated square base, at the four corners of which four muscular genii are seated. The third prize has been given to Franz Rathansky, a young sculptor, for a sitting figure of Mozart with rich adornment in the rococo style.

A Tunnel under the Quirinal.—The municipality of Rome has sanctioned the plans of an undertaking which will establish direct communication between the old parts of the city surrounding the Piazza di Spagna and the new quarters of the Via Nazionale. In order to effect this improvement, it is proposed to pierce the hill of the Quirinal by a tunnel leading from the Via Tritone to the Via Nazionale, and having a length of 1,115 ft. and a width of 51½ ft. The expenditure is estimated at 71,000*l.*

Illustrations.

NEW BOARD SCHOOLS, BEVERLEY-ROAD, HULL.

THESE schools, which were opened in May last, are situated at the corner of Stepney-lane and Beverley-road, the main road into the town from the North. Accommodation is provided for 889 children, in three departments, viz.:—For 301 boys, 301 girls, and 287 infants. The boys enter from Beverley-road, and the girls and infants from Stepney-lane. The main frontage is occupied by a two-story building containing the boys' school on the ground-floor and the girls' school on the first floor, the plans of the two floors being almost identical. Each comprises a T-shaped school-room, 82 ft. by 20 ft., two class-rooms, 21 ft. by 20 ft. each, and two 20 ft. by 18 ft. 6 in. each, with cloak-room, lavatory, teacher's room and store-room. At the back of this building is a cookery class-room, about 20 ft. square, with small scullery and pantry attached.

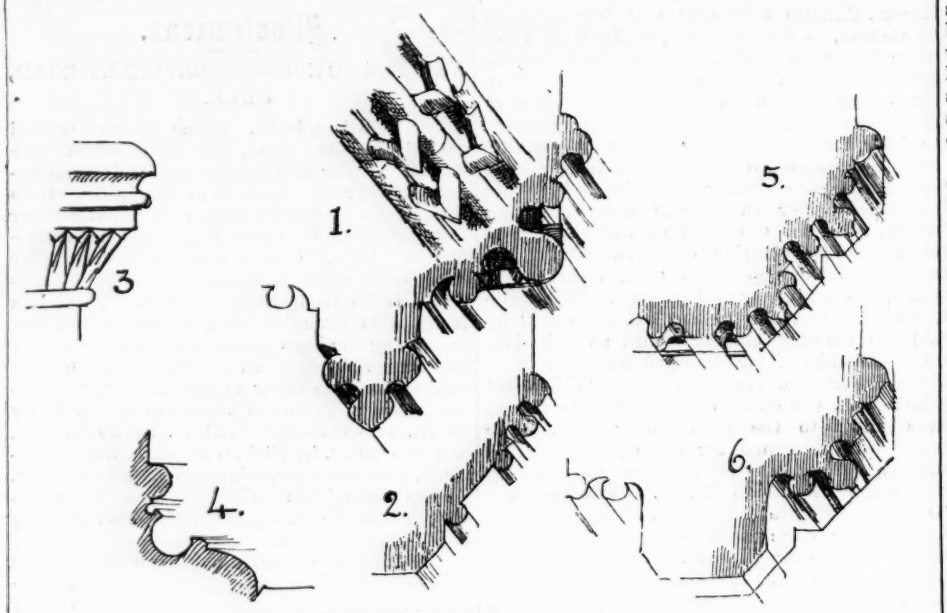
The infants' school, which occupies the end of the Stepney-lane frontage, comprises a school-room, 54 ft. by 26 ft., two class-rooms, 26 ft. by by 20 ft., and 20 ft. by 19 ft. respectively, with cloak-room, lavatory, teacher's room, and store-room. There are three separate playgrounds, with covered playsheds and latrines with automatic flushing cisterns. The buildings are faced with red bricks, with dressings of Ancaster stone, the roofs being covered with Broseley tiles. All the school and class-rooms, corridors, cloak-rooms, and lavatories have a dado of glazed bricks, 5 ft. in height, the remainder of the walls being plastered. The rooms are warmed by high-pressure hot-water pipes and ventilated by inlet tubes in the walls opening into the window bottoms, and outlets in the ceilings into tubes connected with induced-current ventilators in the turrets on the roofs. The buildings have been erected from the designs and under the superintendence of Messrs. Botterill, Son, & Bilson, Mr. W. Botterill being architect to the Board, Mr. J. T. Skinner, of Hull, being the contractor.

SOME OLD ENGLISH BRASSES.

THE brasses given here are from rubbings by Mr. A. Oliver, and formed a portion of the illustration to the paper read by him before the Architectural Association, and given on another page.

ST. CANDIDA, WHITECHURCH CANONICORUM.

ABOUT four miles from the charming little watering-place and port of Lyme Regis, in a secluded valley, lies the pretty village of Whitechurch, called Whitechurch Canonicorum, no doubt partly to distinguish it from numerous other villages called Whitechurch in other parts of England, and partly on account of the fact that its church has at some time of its history been served by clergy attached to a collegiate establishment. The church, of which we give an illustration, is in many ways a remarkable structure; in the first place, its dedication to St. Candida, or in plain English St. White, claims attention. St. White was a Saxon princess who was put to death by the Danes, and her body is buried in the church under a somewhat singular tomb in the north transept,—of this we shall have more to say further on. Guidebooks tell us that this Whitechurch, like many others in the country, receives its name from the fact that the church was whitewashed outside. But is it not far more probable that Whitechurch is simply a translation of "Ecclesia S. Candidæ," the Church of St. White, corrupted first into White's Church, and then into Whitechurch? It seems absurd to suppose that a place should have taken its name of Whitechurch from the distinctive colour of its church, when probably nine churches out of ten were of the same colour; besides, if this were the case, how is it that we have no "Redchurch," "Brownchurch," or "Greychurch," up and down the country? Although little is known now as to St. White or her history, it is by no means improbable that great reverence may have been paid to her memory in the Middle Ages; and this seems to be proved beyond dispute by certain architectural peculiarities, to which we shall have to draw attention, in the church which is her burial-place.



Details of Mouldings, Whitechurch Canonicorum.

1. Third arch, north aisle.
2. Chancel arch.
3. Capital, second column.
4. Base, first column, south side.
5. Arch between aisle and south transept.
6. Third arch, south aisle, nave.

Whitechurch St. Candida is a far more stately and dignified building than we are accustomed to find in villages even of the largest description. It consists of a fairly spacious nave with a clearstory and north and south aisles, rather deep transept, a chancel, and a lofty western tower. Externally, the building appears to be, for the most part, Perpendicular. This character is given to it chiefly by its very noble tower, which is a fine example of the usual Dorsetshire type, *i.e.*, it has solid pinnacles at the angles, a panelled battlement, and a single large belfry window in each face. There is some interesting carving about the parapet, with sculpture in low relief, which is supposed to represent various trades, &c. Most of the windows of the church are also Perpendicular insertions, and the same may be said of the parapets, buttresses, &c., in the chancel. However, there are some very peculiar-looking lancet-windows, which, at first sight, look like Early English work, but the mouldings have a late fourteenth-century character about them, so they really are probably Perpendicular imitations of Early English work. This peculiarity is to be met with in other churches of the West of England, notably Ottery St. Mary's. The interior of the church is singularly interesting, and offers a number of architectural and antiquarian enigmas and problems which are not altogether easy to solve. Few churches in the country present such an admixture of styles,—in fact, we had almost used the word "jumble." The earliest part of the building is without doubt the south wall of the nave. This wall has the appearance of having been at one time immensely thick, and it would seem that originally there was no south aisle to the nave; it is at present pierced by three very wide arches, opening into the south aisle, the centre of which is the earliest in point of date, and is pure Norman; the westernmost arch is of Transitional character, and that to the east is Early English, rather well moulded. The chancel arch and that leading from the south aisle into the south transept are also Early English, though the last-named is far more richly moulded, and is a very handsome piece of work. The way in which the arches have been pierced through the south wall of the nave is most peculiar; in fact, singularly clumsy. At first sight it looks as though there had been a heavy vault corbelled out from the wall, but this is not likely to have been the case. What the date of the wall itself is, it seems difficult to ascertain, though it is probably early Norman or Saxon work, the arches leading from the nave into the transepts are Perpendicular work, panelled like those of Sherborne Abbey. The chancel is less interesting than the other portions of the church. It contains a very curious Elizabethan monument,—we think to one of the Wadham family,—and has a singular roof, with a sort of conventional imitation of fan-tracery painted upon it. It is probably not old in its present condition, but is so singular that it is, in all probability, a badly-executed copy of some old work. The roof of the nave is a good example of fourteenth-century work, though it appears to have been a good deal restored.

Now we come to the most interesting portions of the church, the north transept and the north aisle of the nave. These are for the most part remarkably rich Early English work. At the north end of the transept, under a Perpendicular window, is the shrine of St. Candida. It is at present a plain square sarcophagus supported upon a basement pierced by two pointed arched apertures, each about 2 ft. high. The whole is evidently thirteenth-century work. We were informed that some years back the tomb was opened and a body was discovered in it. We fear that considerable injury must have been done by this operation, as the slab is now broken and the whole covered thickly with whitewash. On either side of the tomb are very rich groups of Early English shafts, with finely-carved capitals and moulded bands. These at present support nothing, but, in all probability, they formerly were portions of a canopy or baldachino over the shrine; similar groups of columns support two richly moulded arches in the east wall of the transept, beneath which there must have been altars; the arches opening from the nave into the north aisle are singularly rich Early English work, and are evidently a portion of the alteration to the church, which must have taken place when the existing shrine of the saint was erected, it is of quite a different character to the other portions of the building, far more elaborate and magnificent, and seems to point out, as we have previously remarked, that very great reverence must have been paid in pre-Reformation times to the memory of St. Candida. We should mention that the church contains a fine late Norman font* and a good Jacobean pulpit and monument, and built into the wall of the churchyard are fragments chiefly of a Perpendicular date, which may have formed portions of the dwellings of the canons who gave the distinctive title of Whitechurch Canonicorum. The church is, we understand, about to be restored, under the direction of Mr. Vialls.

H. W. B.

* The words "Candida . . . Candidiorq" . . . can still be traced upon this font.

MANOR-HOUSE, OCKWELLS, BERKSHIRE.

THIS interesting old house is about a mile from Bray and two from Maidenhead. Built during the reigns of Henry VI. and Edward IV., it is still a fairly-perfect example of the house of the period, although the buildings which formed the north and south sides of the outer quadrangle have disappeared, leaving only a wall with one or two doors on the south side. The main structure is of brick and timber work, built, as will be seen by the plan, round a cloister court. The east front is formed by the projecting porch, the large hall, and the withdrawing-room, the hall being the full height of the building, which is elsewhere two stories in height. The porch has some good spandrels on the outer and inner doorways, with carved dragons of very spirited design.

The hall is at present lighted by two windows on the east side and a fine projecting bay. There were formerly two other windows on the west side, but these have been blocked up, probably to strengthen the walls, which have given way considerably, owing to the weight of the roof. The roof is now hidden by a plaster ceiling, and the stained glass formerly in the windows, with the arms of the Norreys family and their motto, "Feythfully serve," has been removed to Taplow Court. The minstrels' gallery still remains, approached by a stair in the centre of the south block. The withdrawing room, the room over it, and another at the south-west angle, still retain a good deal of their panelling, which is, however, later in date,—Elizabethan. Of this date is also the principal staircase, which was built into the cloister quadrangle, almost entirely blocking it up. There is a good screen at the foot of the stairs, but no very elaborate detail. The cloister itself is of wood, glazed throughout, and of two stories in height. Two sides, the west and south, only remain, the north side having been destroyed when the staircase was put in. Outside the north-west and south sides of the house are plain in character, but the chimneys, though simple, are picturesque.

Ockwells has recently been a subject for discussion in the Law Courts, and has been leased by Mr. T. Smith, of Maidenhead, who, we believe, contemplates making some alterations in order to accommodate it to more modern requirements. The alteration of these houses for present use is always attended with a certain amount of danger; but it is to be hoped that Ockwells will be spared any mutilation that is not absolutely necessary, as it is at present one of the most perfect houses we have remaining.

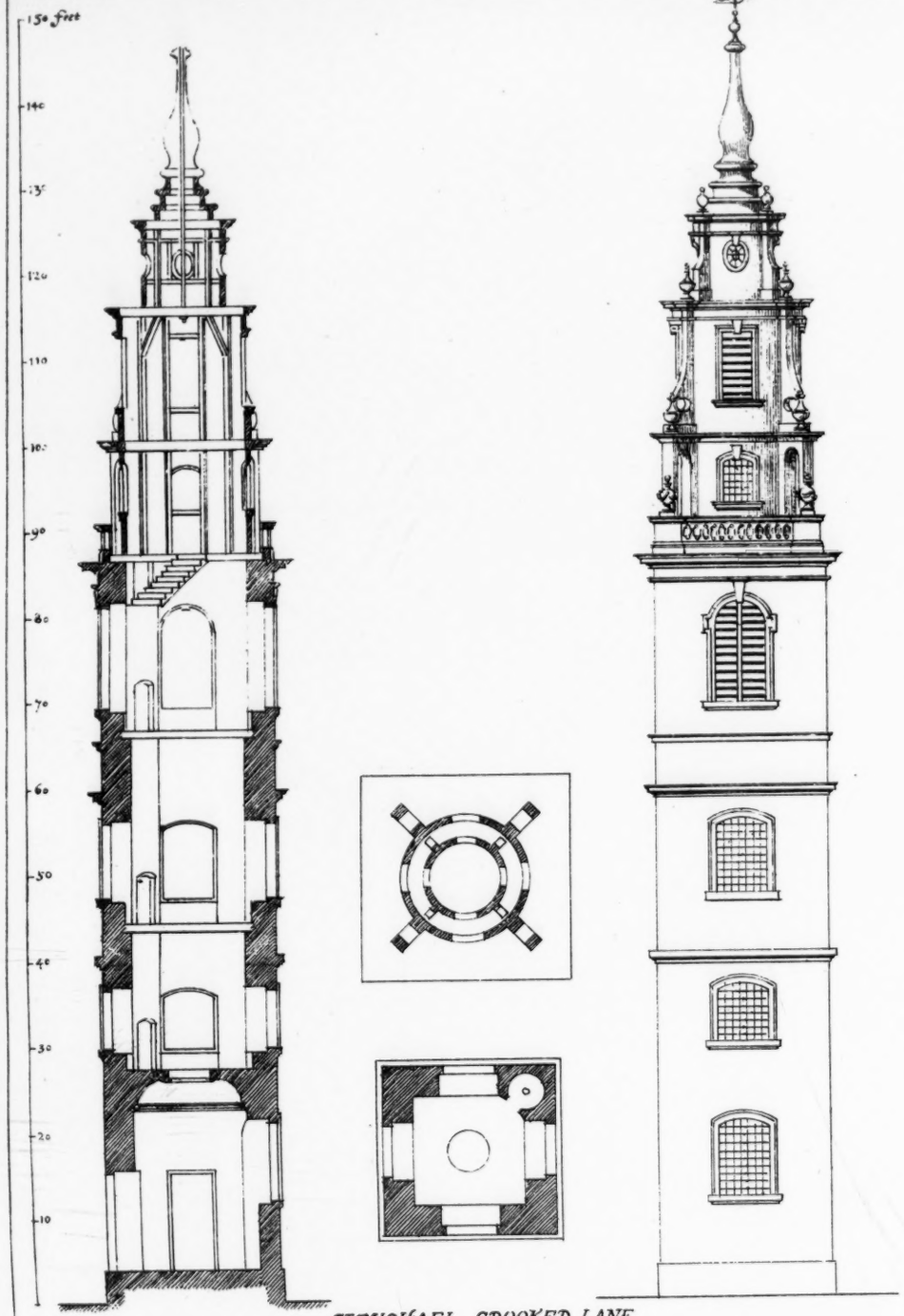
CITY CHURCHES, NOW DESTROYED.

THE two pages of lithograph shewing St. Bene't, Gracechurch, and the towers of St. Michael, Crooked-lane, and of St. Antholin, are reproduced by permission from Mr. W. Niven's admirable illustrated work on City Churches now destroyed, or whose destruction is threatened, which we referred to at some length in an article in the *Builder* of December 31, on "Some Recent Illustrative Works," where we made some comments on the examples we have here reproduced. The tower of St. Antholin, which will be well-remembered by many of our readers, stood for some time as a conspicuous object close adjoining the southern side of Queen Victoria-street after the church itself had been removed. As a classic adaptation of the spire it is very clever; the defect in the design is in the junction between the square and octagon portion of the tower, which is poorly managed, and the tower is hardly massive enough in design to harmonise with the superstructure.

We give, also from Mr. Niven's book, the plan of the City of London with its churches, those which are standing being shown shaded, those which are removed black. Probably a good many of our readers will be startled to see what a considerable number of these old architectural monuments have been removed.

Jennings's Automatic Apparatus for Discharging Fluid Disinfectants.—With reference to the descriptive notice of the above, which appeared in our last issue, Mr. George Jennings writes us pointing out that it should have been further stated that the application of the improved mechanical arrangement originated at the suggestion of Mr. T. de Courcy Meade, A.M.I.C.E., Surveyor to the Hornsey Local Board, who has for some time past given consideration to the desirability of securing a more systematic application of disinfectants and their automatic distribution in connexion with road watering and flushing tanks, and that a patent has been applied for in their joint names.

Bolton.—The theatre just destroyed is to be rebuilt, from designs of Mr. F. Matcham, who is also rebuilding the "Grand Theatre" at Islington.

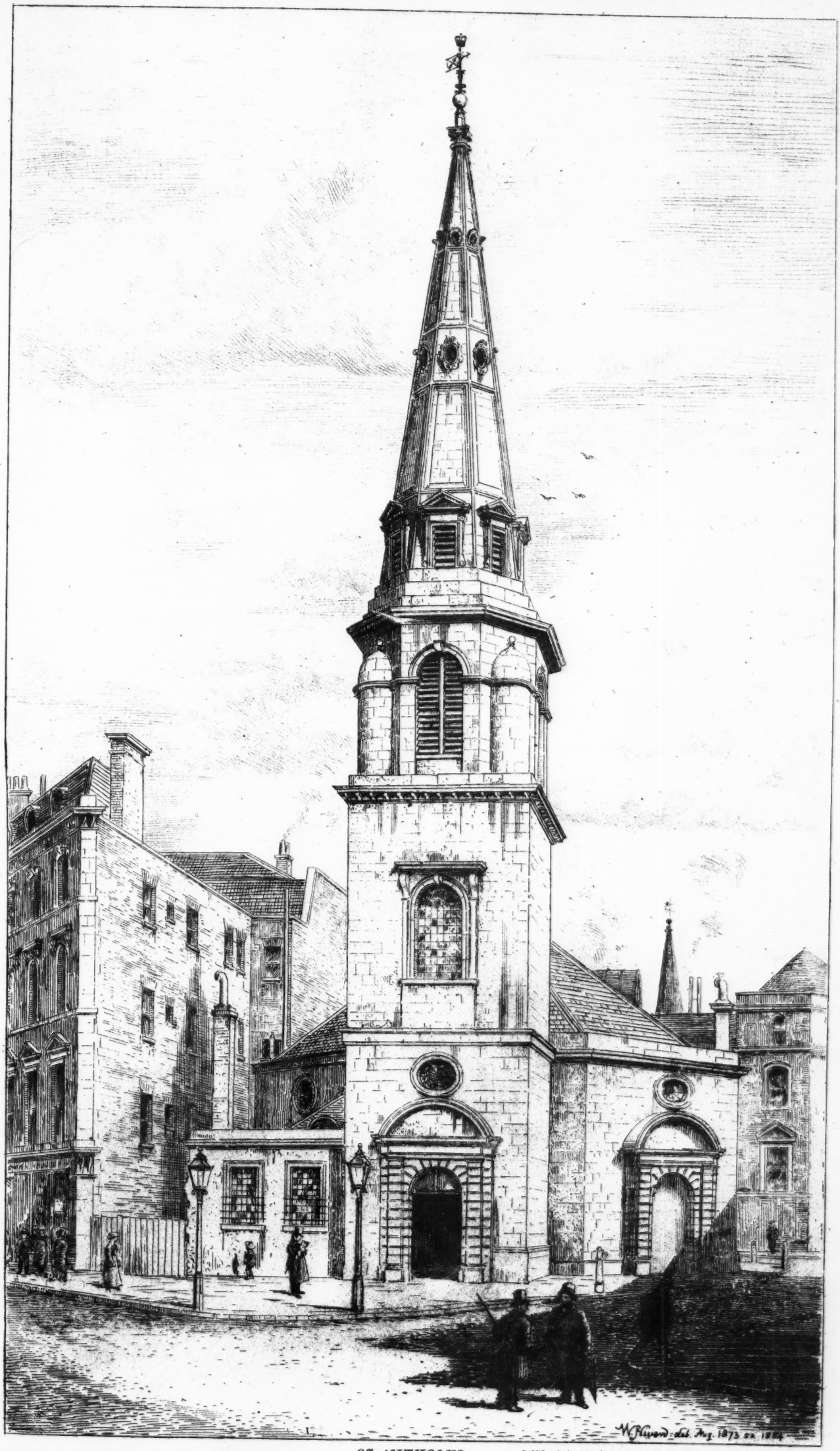


ST MICHAEL, CROOKED LANE

ST BENE'T, GRACECHURCH.

PHOTO-LITHO, SPRAGUE & Co 22, MARTINS LANE, CANNON ST, LONDON, E.C.

CITY CHURCHES BY WREN: NOW DESTROYED.—FROM DRAWINGS BY MR. W. NIVEN.



St ANTHOLIN.

PHOTO-LITHO. SPRAGUE & Co. 28. MARTINS LANE, CANNON ST. LONDON, E.C.

CITY CHURCHES BY WREN: NOW DESTROYED.—FROM DRAWINGS BY MR. W. NIVEN.

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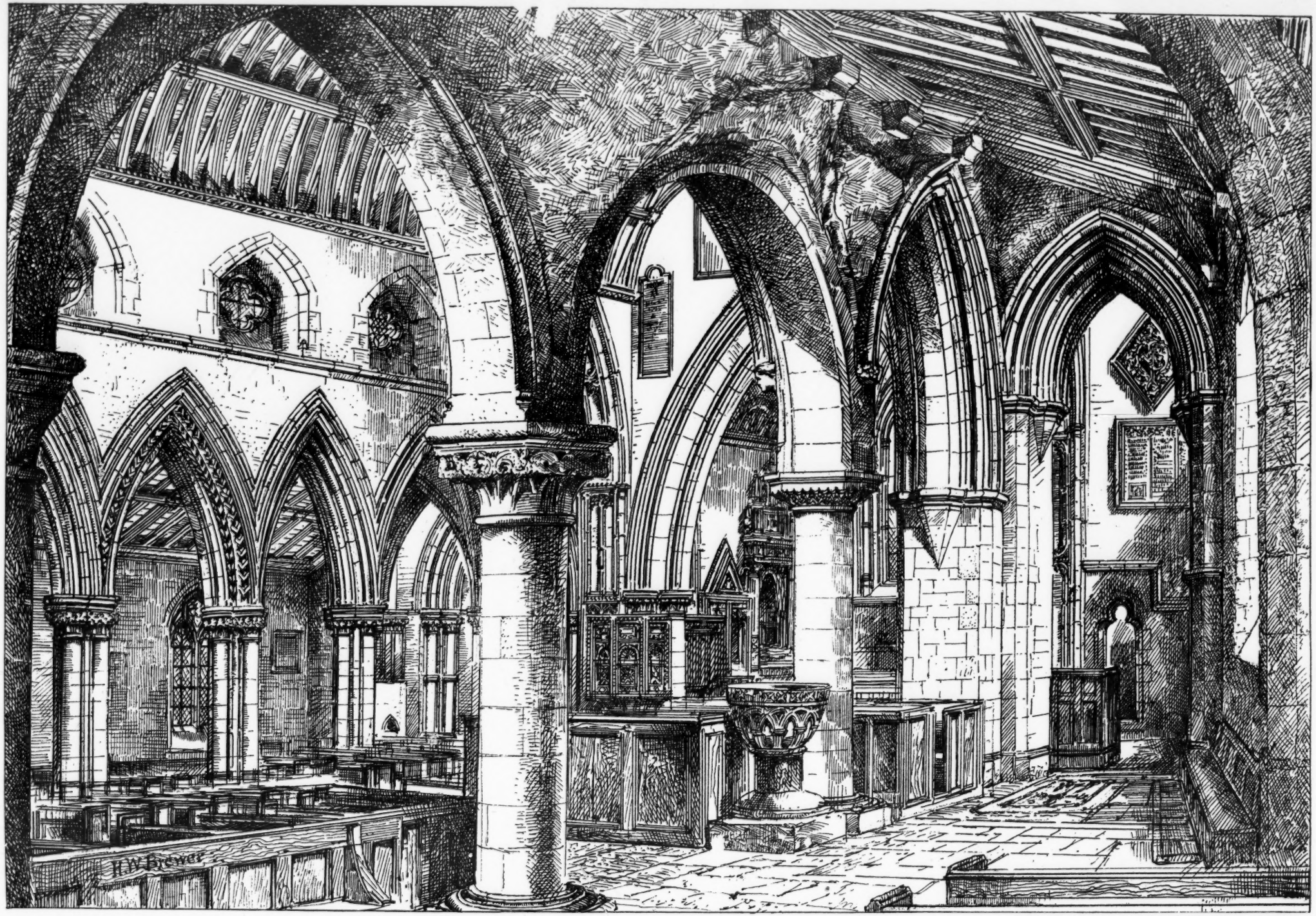


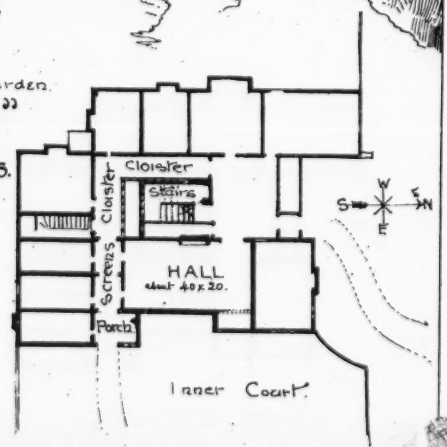
PHOTO-LITHO. SPRAGUE & Co., 22, MARTINS LANE, CANNON ST. LONDON, E.C.

ST. CANDIDA, WHITECHURCH CANONICORUM, DORSETSHIRE.

Manor-House of "OCKWELLS" near Maidenhead. Berks.

The East Front.

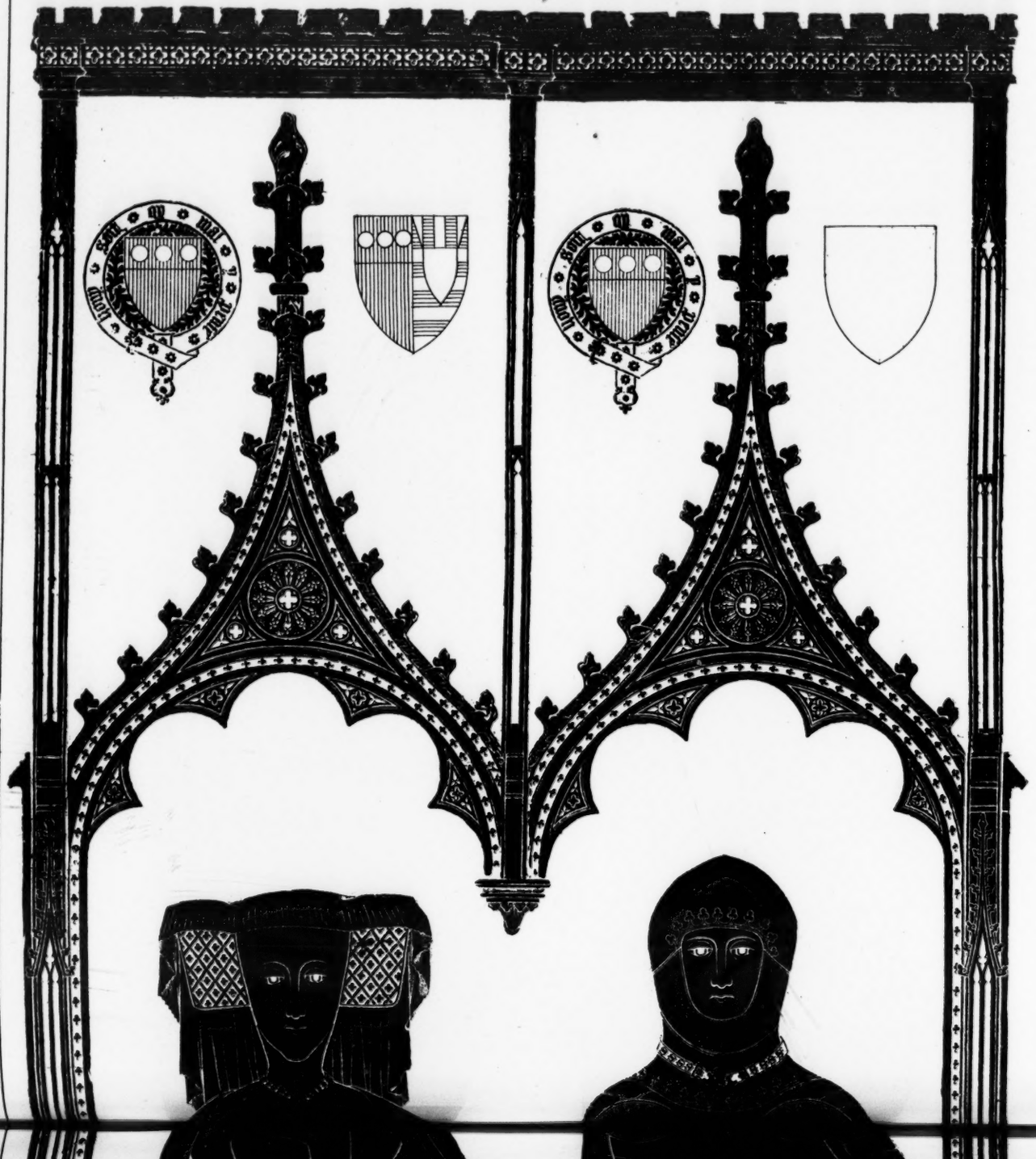
Spandrils from Porch.



Sketch-plan not to Scale.

South-West view.

PHOTO-LITHO. SPRAGUE & Co 22, MARTINS LANE, CANNON ST, LONDON, E.C.



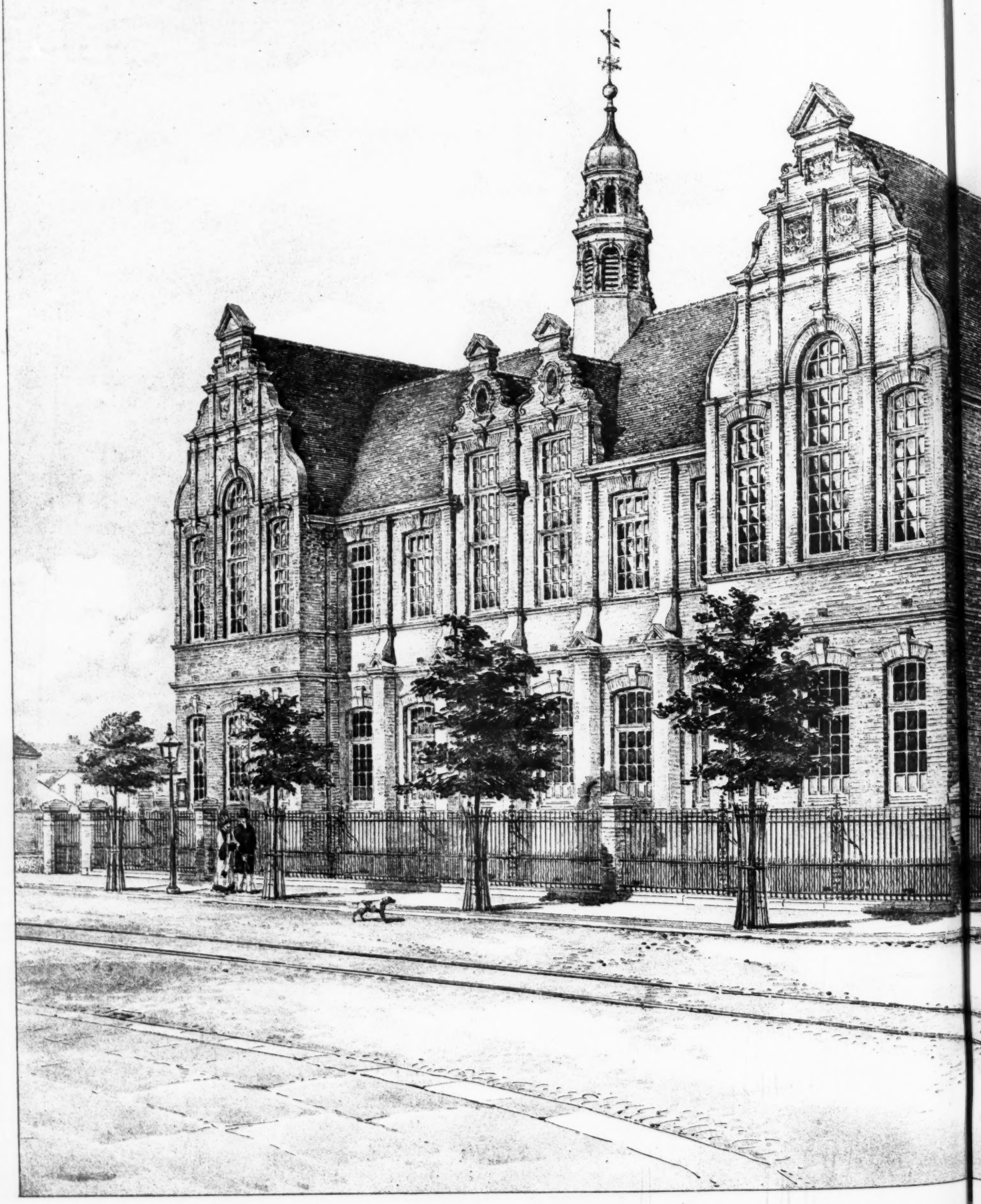
PORTION OF A FLEMISH BRASS. BRITISH MUSEUM, 1360.

LORD AND LADY CAMOYS. TROTTON, SUSSEX, 1424.

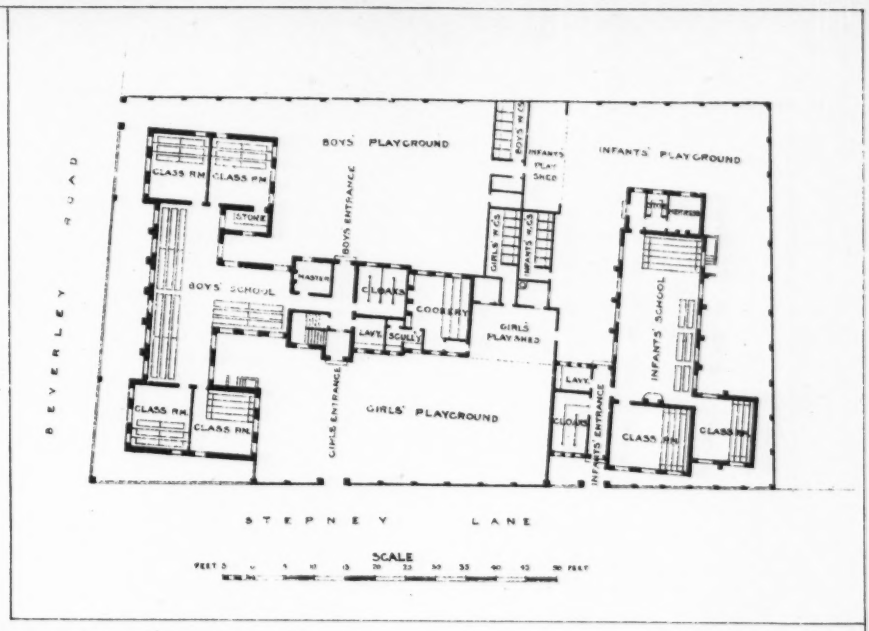
SIR JOHN AND LADY DE CREKE, 1325, WESTLEY WATERLESS, CAMBRIDGESHIRE.

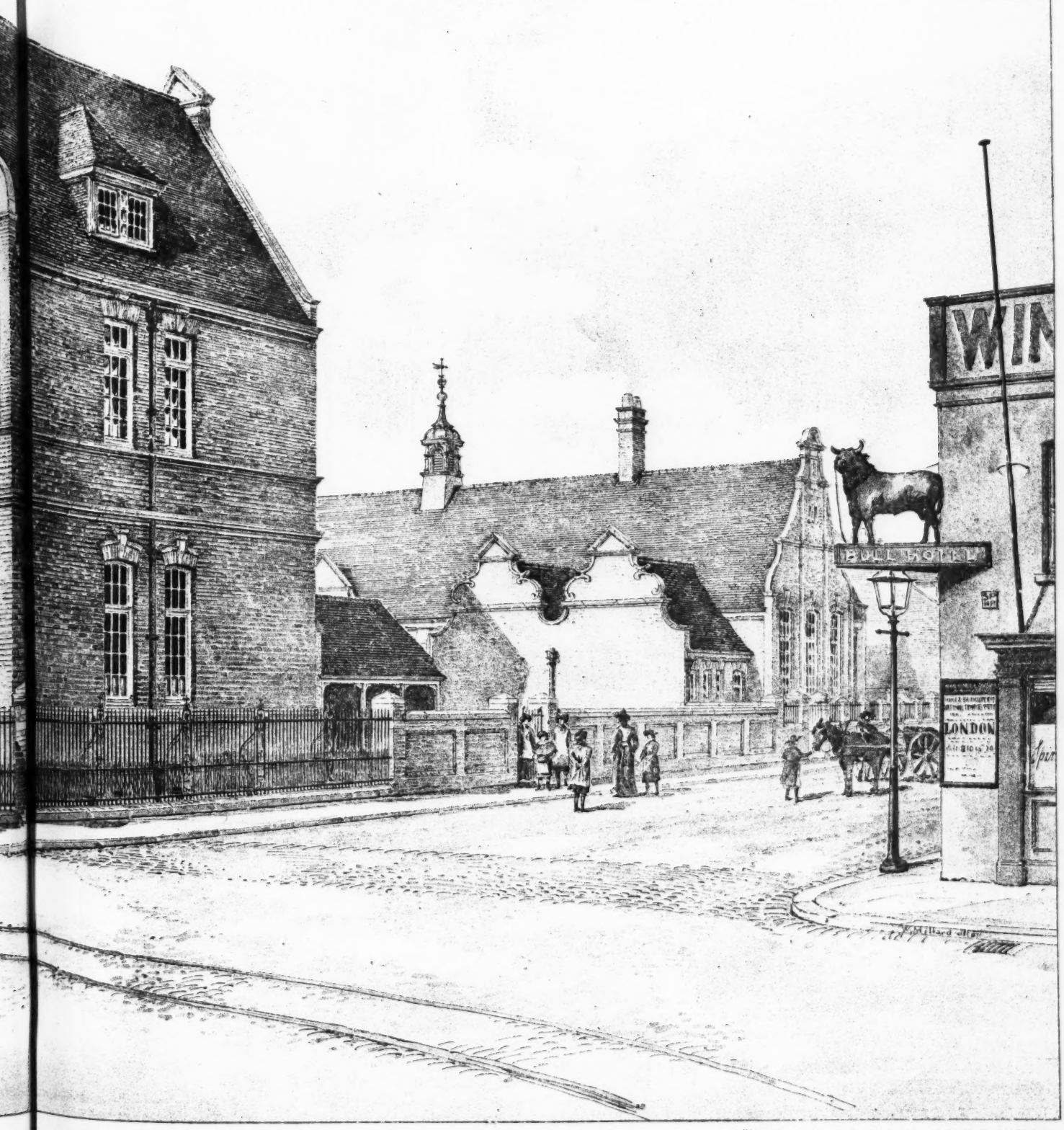
PHOTO-LITHO, SPRAGUE & Co 22, MARTINS LANE, CANNON ST, LONDON, E.C.

SOME ENGLISH BRASSES.—From Rubbings taken by Mr. A. Oliver, A.R.I.B.A.

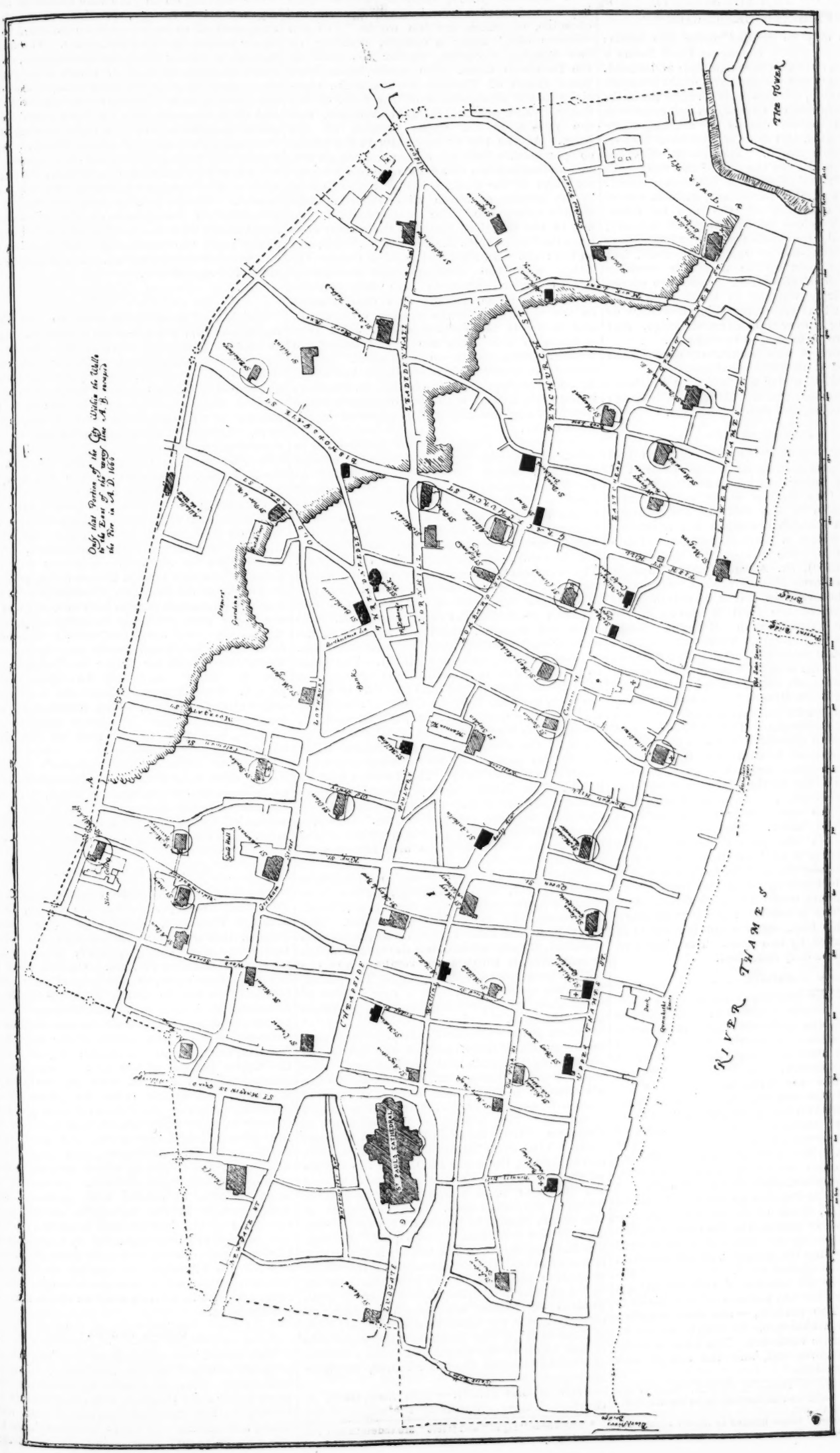


NEW BOARD SCHOOLS, BEVERLEY ROAD, H[ULL]





[illegible]D, H[illegible]L.—Messrs. Botterill, Son & Bilson, Architects



Plan showing the City Churches, those now destroyed being shown in black.—From "London City Churches," by Mr. W. Niven.

BRASSES OF THE FOURTEENTH AND FIFTEENTH CENTURIES.*

BRASSES may be divided under two heads: first, those in which the brass itself forms a background, as in Flemish examples; and second, those in which the various parts of the brass are let into the slab, the slab itself forming the background. Brasses of themselves are important studies, as various details of armour, vestments, costume, and even architecture may be obtained from them. The finest examples are to be found from the end of the thirteenth to about the middle of the fifteenth century. The brasses of this period are, without doubt, the finest examples of the age of brass. Towards the close of the fifteenth century, and, indeed, for some time previous, there is great falling-off in design, execution, and detail. The bold outline and firm drawing characteristic of the earlier brasses are wholly if not entirely wanting in those of a later period. At that time everything was more or less getting towards a debased stage, and brasses were no exception to this rule.

I will now end this preliminary explanation and proceed at once to the subject.

It is divided under the following heads:—Flemish Brasses, Priests', Knights', Civilians', Ladies', Crosses, and Bracket Brasses.

FLEMISH BRASSES.

One great contrast between English and Flemish brasses is in the large space covered by diaper and other work, and workmanship generally. One feature which is differently shown consists in the folds of the drapery, which, in a Flemish brass, are cut regardless of pattern, whilst in English brasses it is subordinate to it. The brasses at the British Museum† (1360), St. Alban's (1360), Topcliffe (1390), and North Mimms (1360), are similar in design, but vary in points of detail. The representation of the Soul is shown in the canopies at the British Museum, North Mimms, and Topcliffe, while St. Alban's has the Saviour enthroned. The double canopies shown in the St. Alban's example, containing figures of saints, are changed to single canopies in the others, North Mimms having saints similar to St. Alban's, whilst Topcliffe has angels playing on musical instruments. The outer edge and inscription, with shields of arms in the centre, are similar both at Topcliffe and St. Alban's. In the former case it is of a smaller scale. North Mimms has neither pattern round the edge nor inscription. The diaper work is slightly different in the two former cases, but it is wanting in the latter. The vestments are similar in both the priests' brasses, Abbot Delamere having in addition the mitre and pastoral staff, thereby showing his rank as a mitred abbot. He is represented as standing on two fighting monsters, beneath which is an elaborate basement. The priest at North Mimms has a stag under his feet, below which is a shield of arms, supported by two lions. The figures at Topcliffe will be duly described.

PRIESTS.

Priests of the fourteenth century are generally in eucharistic vestments; the chasuble fits close, and the amice lies loose on the neck, and not, as shown in later brasses, like a stiff collar. The stole and maniple are wider at ends than centre, and the apparels at ends of wrists are continued round in the first half of the century. Later, only a small square is placed on the upper side of the sleeve. Orphreys are engraved with long, square, or circular compartments, with ornaments of the same shape. The hair is long, and flowing behind the ears; the beard is shown by dots, and the eyes by a straight line underneath.

Grenfeld.—The brass to Archbishop Grenfeld at York, 1315, is one of the earliest ecclesiastical brasses. It represents the prelate in full vestments, wearing the mitre with its fringed ends, and holding the crozier with the vexillum or scarf in his gloved hand. The folds of the drapery (as in all brasses of this period) are boldly drawn, but the position of the hands is awkward. The pallium,—the distinguishing mark of an archbishop,—is clearly shown as being a separate vestment. The brass is mutilated at the lower end, and the canopy and inscription are lost.

* A paper by Mr. A. Oliver, A.R.I.B.A. Read at the meeting of the Architectural Association on the 6th inst., as elsewhere mentioned.

† The top of one of these brasses is shown among our photo-litho illustrations.

L. Seymour (1337), *Higham Ferrers.*—This brass consists of a grand central figure in the chesuble, on which are the words "*Fili Dei miserere mei*," under a canopy, standing on two fighting monsters, similar to those in the Delamere brass. The whole brass itself bears traces of Flemish workmanship, especially in the arrangement of the folds of the drapery, the saints in side canopies, and the figures in the upper portion of the brass. At the top of the brass in the centre compartment is God the Father holding an orb, and underneath are two angels holding a representation of the Soul, which may also be seen in the brasses at North Mimms and Topcliffe already referred to. The compartment to the left of the principal figure in the canopy contains the figures of St. Andrew and St. Peter, and on the right * St. Paul and another Saint. On either side are compartments containing figures under canopies; two only remain on the left side. In the first compartment on the right is a figure writing on a scroll, and below is the symbol of St. John (the symbols in this brass are placed under the top and bottom figures on each side). In the second, an angel with a scroll; in the third, St. John the Baptist; in the fourth, St. Stephen; in the fifth, a monk with a pastoral staff; in the sixth, a figure writing, with the symbol of St. Luke under.

Shottesbrooke (1370).—The brasses to a priest and civilian are under a double canopy crocketed, which resembles the canopy at Fletching, originally divided by a central shaft (now lost). Both are good examples of vestments and costume. The features are well expressed, the hair long and flowing, and the ears large and prominent, and there is great boldness shown in the drawing of the drapery. The ornaments on the vestments are the square rose and the fylfot cross. The latter was a common ornament of the fourteenth and fifteenth centuries, but rarely seen later. The stole and maniple, which are broader at the ends than the centre, have the same ornament.

Bishop Wyvil, Salisbury (1375).—The brass to Bishop Wyvil at Salisbury commemorates a dispute the Bishop had with the Earl of Salisbury. In the year 1139 the Castle of Sherborne was seized by the Crown. In 1337 Edward III. granted it to Montacute, Earl of Salisbury. The claim of the See never having been renounced the Bishop profited by its transfer to private hands of a writ of right. This meant a trial by battle. The King, however, postponed the combat, and the Bishop ultimately obtained his object by payment of 2,500 crowns. It represents the Bishop in his mitre and crozier over a gateway, in which stands a man armed with shield and battle-axe.

Cranley (1417).—The brass to Archbishop Cranley, 1417, at New College, Oxford, consists of a figure under a triple canopy, mutilated, surmounted by an arched battlement. The effigy is in the same vestments as Archbishop Grenfeld, already noticed, but the crozier, which is mutilated, is without the vexillum, and the head is ornamented with a crucifix. The gloves, which are embroidered, have a ring on one of the fingers, and embroidered shoes may be seen below the cope.

Priests of the Fifteenth Century.—These may be distinguished from those of the fourteenth century by the stole and maniple being the same breadth throughout. The orphreys are ornamented with foliated circles, containing leaves, flowers, or initials, instead of a square ornament. The brasses to W. Fulborne, at Fulborne, 1370, R. Malford, New College, Oxford, 1410, John Mapilton, Broadwater, 1420, and S. Clerke, Horsham, 1430, have the initials of the priest down the border of the cope, and the Horsham brass shows the crossed stole, which is not often seen. The fine brass at Warbleton, Sussex, to William Preswyck, 1436, has the text from Job, "Credo quod," &c., embroidered on the cope. The tracery in the canopy is similar in both the Broadwater and Warbleton examples; the finial of the latter terminating in "a pelican in her piety" with a scroll over. Figures of saints are sometimes seen on orphreys, as in the brass to John Bache, 1414, at Knebworth. The figures on the right side of the cope are the Virgin and Child, a Bishop, and St. Andrew, on the left St. Paul, an Archbishop, and St. James.

Prior Nelond (1433).—This fine brass, at Cowfold, Sussex, consists of the effigy of the Prior standing on an elaborate basement under a grand triple canopy, the sides of which are composed of canopied niches connected to the upper portion by flying buttresses. The finials, instead, of having the usual termination, end in small brackets, on each of which is a figure, a small scroll bearing the name being placed over the heads of each. The centre one has the Virgin and Child crowned, with its hand raised in the act of benediction; on the right bracket is St. Pancras, patron saint of Lewes Priory, holding a palm and book and standing on a figure. On the left is St. Thomas of Canterbury, the patron saint of the Prior, in vestments with mitre and crozier. Scrolls issuing from the hands are addressed to the figures on the brackets; a small shield with the symbol of the Trinity is at the right top corner, the corresponding one on the other side being lost. The inscription is mutilated on one side.

* The words "right" and "left" are the right and left of the figures.

MAIL PERIOD.

Knights.—The early brasses to Sir John Dabernon, 1277 (which is the earliest existing), at Stoke Dabernon, Surrey, Sir Roger de Trumpington, Cambridge, 1289, Sir Robert de Bures, 1302, at Acton, Suffolk, and Sir Robert de Septvans, 1306, Chartham, Kent, show more or less the same features. In addition, the brasses of De Septvans and Trumpington have "ailettes" or wings attached to the shoulders, charged with the knights' arms. The shields, with the exception of that of De Septvans, are carried on the left side by a strap passing over the right shoulder, which in the case of De Septvans is passed over the left shoulder; they are all charged with the Knight's arms, and in addition the surcoat of De Septvans is similarly embellished. The shield worn by Sir John Dabernon has the heraldic tincture nearly, if not quite, perfect. The shield of Sir Roger de Trumpington is unfinished, as a small portion only is cut away at the lower side, evidently intended to receive the colour. All have the swords suspended from broad belts, and cords are round the waist, from which Sir Roger de Trumpington has a chain attached to the tilting helmet. The brass to De Septvans is slightly different to the others, as the hands, head, and face are uncovered. The brass itself is unfinished, a portion of the mail on the right ankle being only completed.

Sir John Giffard (1348), *Bower's Giffard, Essex.*—This brass is the latest example without plate armour on the arms or legs, and the earliest showing the jupon. The shield is suspended from a strap and bears the knight's arms. The sword hangs from a belt in front of the figure.

MAIL AND PLATE PERIOD.

The brasses to Sir De Fitzralph, 1320, at Pebmarsh, Essex; Sir John De Creke, 1325, Westley Waterless, Cambridge (see photo-litho in this week's *Builder*); and Sir John Dabernon, the younger, 1327, show plate armour in addition to mail. On the head is the steel bascinette, to which is attached the hawberk, but the Pebmarsh brass has the head covered with a mail cap. Roundels or circular plates are attached to the elbows and shoulders, demi-plates cover the outside of the upper and forearm, the shins are protected by jambs, and the upper portion of the feet by sollerettes. Instead of the surcoat worn in the earlier examples, the cyclas takes its place. This garment, except in the Pebmarsh example, was shorter in front than behind, and laced up at the sides. Below the cyclas, and above the hawberk, is the gambesson, and below the hawberk is the haqueton, which reaches to the knee-plates called genouillieres. Chaussées, or short breeches of banded mail, protected the upper portion of the legs. The shields bear the arms of the knights, and is carried on the arm instead of being suspended by a strap as in the Pebmarsh. The swords of Sir John Dabernon and Sir De Fitzralph are carried by a broad belt, but in the other example it hangs from a strap attached to swivels fixed on either side of the scabbard.

CAMAIL PERIOD.

This period is so called from the deep fringe of mail attached to the bascinette, in early brasses by laces, and later by staples. The brass to Sir John Cobham, 1354, may be said to belong to the transition period of mail and plate, and camail. It bears a resemblance to the former period, from being similar to the

brasses at Stoke Dabernon, Westley waterless, and Pebmarsh, in the demi-plates in the arms and legs, to Sir John Giffard in the long jupon, and to those of a later date in the camail.

The bascinette is pointed. Under the hawberk or mail shirt was most probably worn a breastplate, and over the mail a jupon. The hands are covered by plain gauntlets, like those worn by Sir John Dabernon. In the later brasses the jupon is cut shorter, not reaching lower than the hips, which length it never exceeded. The broad belt worn in the earlier examples has disappeared, and its place is taken by a bauldrick buckled or clasped either in front or at the side, the sword hanging from the left side of the figure instead of from the front, whilst the dagger was placed on the right. The upper part of the legs of Sir John Cobham, 1365, is covered in studded mail, which went over the mail breeches, reaching as far as the knee. The knees were protected by iron plates of a pot-lid shape; the upper and lower parts of the legs were also protected by iron plates. The epaulettes were in three pieces, and mail armour may be seen at both armpits and elbow-joints. The shoes were pointed, and jointed to allow of easy movement. Lions and other animals were usually placed under the feet. The pommel of the sword is hexagonal in the upper portion, a corded ornament being round the hilt, and the hilts of the sword and dagger had straight guards, and were ornamented.

Sir John Foxley (1378).—The brasses of Sir John Foxley and wives stand on a bracket, which rests on a stem with a fox at the base. At his death he left express injunctions as to the making of the memorial. Mr. Waller gives the following account:—"Sir John Foxley died in 1378, and by his will directed his executors to procure two marble slabs, one to the memory of his parents, and the other representing himself in his arms, the image of his deceased wife, in the arms of himself and his said wife, and on the image of his wife living in his arms only." Above the heads of the figures may be traced the matrix of a triple canopy.

Sir John Dalynruge (1380).—This resembles the brass last described, having the arms on the jupon. On the left side of the knight is his wife. A double canopy crowned with a battlement, and divided down the centre by a shaft, is over the figures.

Sir Robert Swynburne (1391).—The brasses at Little Horkesley, Essex, to Sir Thomas and Sir Robert Swynburne have splendid double canopies over the figures, shields bearing arms being attached to the shafts. The knight's initials are worked on the baldrick.

Sir Reginald Braybrooke (1405) *and Sir Nicholas Hawberk* (1407).—These two effigies stand under somewhat similar canopies; the upper compartment in both instances having a representation of the Holy Trinity. Sir Nicholas Hawberk stands under a canopy of an ogee shape. The upper portion contains three compartments, the two side ones being connected to the side shafts by arches, under which is, on the right side, the Virgin and Child, and on the left St. George. From the shafts hang shields of arms. On a small pedestal at the foot of the brass is a representation of the Knight's son, and Sir Reginald Braybrooke has a son on either side on similar pedestals.

PLATE AND TACES PERIOD.

In the brass of Sir Reginald De Cobham (1403) a period of transition may be observed, the brass partaking of both the camail and plate and taces periods. To the camail from having the distinctive feature of that period, and to the later period from wearing cuirass and taces, and discarding the jupon. The armpits are covered with the tight-fitting breastplate, and the mail is no longer visible as formerly. The baldrick is worn, but the sword and dagger are attached in a different way, being suspended from a leather socket, the scabbards of both being ornamented.

About the year 1410 plate had quite taken the place of mail as a means of defence. Instead of the camail a gorget is attached to the lower part of the bascinette, the epaulettes are in several pieces, and the space under the armpits is protected by roundels, and, later, by oblong plates termed pallettes; fan-shaped plates are attached to the elbows. The baldrick is worn, and, in addition, a narrow belt carries the sword, which later took the place of the baldrick.

Sir Thomas de Swinborne (1412).—This is one of the earliest as well as one of the finest brasses of this period. The effigy lies beside that of his father, already described, at Little Horkesley, Essex. The knight is in complete plate, with the collar of SS. round the neck, a small fringe of mail appearing at the end of the gorget and at the bottom of the lowest tace. The roundels are charged with the cross of St. George. The scabbard of the sword is enriched with a flowing pattern as well as the belt which passes across the body.

Lord Camoys (1424).—The fine brass of Lord Camoys at Trotton Church, Sussex, together with that of Lady Camoys (see photo-litho in this week's *Builder*), lies on an altar-tomb. His right hand is bare, and clasps that of Lady Camoys; the left, covered by the gauntlet, rests on the sword-hilt. The sword, attached to a narrow belt, is worn across the body, the scabbard being ornamented. The bascinet, the gauntlet cuff, and the edge of the lowest tace are similarly embellished. Both effigies wear the collar of SS., and Lord Camoys has the garter as well. The figures are under a splendid canopy, divided by a central shaft on a corbel into two parts. In the portion over Lord Camoys are two shields, one encircled by the garter, bearing Camoys, and the other Camoys and Mortimer quarterly, the arms of his wife. The space over Lady Camoys has a similar shield bearing her husband's arms, the shield which at one time evidently bore her arms being lost.

Sir John de Brewes (1426).—The brass to Sir John de Brewes, at Wiston, Sussex, is an extremely fine example. The knight is represented as lying on his tilting helmet, surmounted by a lion standing on a cap of maintenance. The joints of the armour are expressed by double lines, and a small twille is attached to the lowest tace. The sword, suspended from a narrow strap girded across the waist, does not hang straight from the side. The slab is covered with the words "Jesus, Mercy," one or two being lost. At the sides and ends of the slab are shields bearing the knight's arms, *azure*, six cross crosslets fichée, a lion rampant *or*, two of which are now lost.

CIVILIANS.

The dress of civilians in the fourteenth century did not undergo much change. It consisted for the most part of a tunic buttoned up to the throat, long lappets similar to those on the ladies' dresses at Bray and Berkhampstead being attached to the elbow, or else without the lappets, with a row of buttons reaching from the elbow to the wrist, as at Rusper, Sussex, in the brass of Kyggesford (1375). A mantle with hood is worn at the early part of the century, as in the brasses of John Peacock at St. Michael's, St. Alban's, and Taplow. At a later period the hood is dispensed with. The mantle is then buttoned and thrown over the shoulder, and the tunic reaches to the knees, as seen at Shottesbrooke (1375), Topcliffe (1390), St. Michael's (1380), and Hildersham (1408). A sword suspended from a belt is worn by the last-named effigies, which was a common feature at the end of the century. The shoes are pointed, and fastened over the insteps. The hair is worn shorter at the end of the century than at the beginning. At the beginning of the fifteenth century the cloak is only to be found on brasses of officials, such as judges, notaries, &c. Instead of the tightly-buttoned sleeves large loose ones secured at the wrist are worn, as at Beddington to Nicholas Carew (1432).

LADIES.

Ladies Camoys and Cobham.—The earliest brass to a lady is that to Lady Camoys at Trotton, Sussex, 1310. It resembles in some respects the brass of Lady Cobham, 1320, the dress being similar in both cases. It consists of a loose tunic, which in the case of Lady Camoys was originally covered by small shields now lost. An underdress may be seen, buttoned at the sleeves; a wimple is under the chin, and a veil over the head. The hair of Lady Comoys is plaited on the forehead, whilst Lady Cobham has hers loose, confined by a small fillet. The canopy over Lady Cobham is the earliest existing; it is straight-sided and crocketed, terminating with a finial, a trefoil arch and foliated spandrels completing the composition. It is carried on a pair of delicate shafts, on which stand pinnacles. Traces of a similar canopy may be seen over the effigy of Lady Camoys.

The brass of Aleyne de Creke (1325) shows a head-dress common at this period. The hair is parted on the forehead, and worn in long plaits on each side of the face. A wimple, drawn up over the chin, is taken up the sides of the face, and fastened across the forehead, and a veil is thrown over the head. She is dressed in a long flowing mantle. After the middle of the century the head-dress is still worn braided. The commonest head-dress is a close cap with the edges plaited, taken straight across the forehead, and down the sides of the face. A veil falls over the shoulders. In the latter part of the century the nebule head-dress came into fashion, consisting of a cap in which the hair was placed, and sometimes fell over the shoulders. This head-dress may be seen in the brasses to the ladies Dalynruge, Foxley, Torrington, and Margaret and Maud De Cobham. The dress consisted of a close-fitting kirtle with long lappets. Towards the close of the century the nebule head-dress was reduced to three rows of frills on top of the head, as in the brass of Lady Margaret De Cobham, 1385. Examples of a different kind, called the reticulated head-dresses, are at Great Berkhampstead and Shottesbrooke. The kirtles worn in these examples are buttoned up to the neck. In the beginning of the fifteenth century the nebule was succeeded by the crespine, the hair in this case being plaited over the forehead and worn in nets over the ears, the usual veil being over the head. The small brass to Joanna Urban, 1414, at Southfleet, Kent, shows an example of this style. About 1415 the crespine gave way to the horned head-dress, in which the sides were at first kept low, as at Hever, 1420, Horley, 1420, Beddington, 1435. The cushion under the head of the figure at Hever is unusual at so late a period. These figures have large falling collars and loose cloaks.

The brasses at West Grinstead to Philippa Halsham, 1440, Lady Camoys, 1426, and Margaret Salmon at Arundel, are good examples of the high-horned head-dress. The example at Arundel has a collar and tunic similar to those at Horley and Beddington, the other two having long cloaks secured by cords.

Widows.—The brasses of Maud Peacock, of St. Michael's, 1349, Margaret De Cobham, 1385, Eleanor De Bohun, 1399, and Topcliffe, 1390, all exhibit similar features in dress, a kirtle with a mantle over. Under the chin is a plaited wimple, only seen on brasses to widows. The brass to Margaret de Cobham has over the head the words "Jesu mercy, Lady help," and on two small scrolls on either side "Jesu, mercy." Shields of arms are at the sides and ends. The inscription at the bottom represents her as the wife of Sir Reginald Braybrook, whom she survived, and whose effigy lies next to hers. The brass at Topcliffe shows buttoned sleeves as far as the knuckles, and the hands are placed in a different position to that usually seen. The brass to Eleanor De Bohun is under a splendid triple canopy; shields of arms hang from the side shafts and are also placed on the base.

CROSSES.

These are of several kinds, the simple cross having the arms either plain ornamented, or with an inscription, with figures or demi-figures in the head, or with one or more persons kneeling at the base. The first-named crosses are shown in examples at Higham Ferrers, 1400, and Broadwater, Sussex, 1415. In the former examples the arms are enriched with a flowing pattern, a representation of God the Father being at the intersection, and the ends terminate in the Evangelistical symbols. The upper portion is carried on a plain shaft, which stands on an elaborate base, underneath which is an inscription to Thomas Chichele. The Broadwater cross has an inscription on each of the arms, which are terminated by a *fleur-de-lis*. It is placed on a plain shaft, with a cap, and rests on a calvary. It commemorates Richard Tooner, and not John Corby, whose inscription is placed at the bottom, the matrix of whose inscription is in the chancel.

Crosses with figures in the head are at Taplow, Stone, St. Michael's, near St. Alban's, and Buckstead, Sussex. The cross at Taplow, 1350, is to Nicholas Aumberdene, and rests on a stem which is placed on a dolphin. The head is of an ogee shape, with foliated ends and cusped points inside head. The cross at St. Michael's, 1380, has the figure of a civilian (the second figure is lost). The head, which resembles the last-named, is mutilated in the foliated ends and the lower part of the stem, on either side of which is a shield of arms. In the head of the brass at Stone is a priest in vestments,

a scroll issuing from the hands, and round the head of the cross is a mutilated inscription giving the text from Job, "Credo quod," &c. Two of the foliated ends are lost, and the beginning of inscription on stem, which has the name "John Lumbard, Rector"; the date of decease is on the calvary. The cross to B. Avenell, at Buxstead, 1370, has the half effigy in the head; the background is covered with diaper work. The foliated ends of the cross terminate in double leaves, which are also repeated down the stem, which rests on a calvary. The inscription, of which one side is lost, consists only of the name and date; the usual symbols are at the corners.

Of crosses with figures kneeling a good example is that to Robert Paris and wife at Hildersham, Cambridge, 1408. A representation of the Holy Trinity is in the head of the cross, to which the figures beneath are praying. Under the effigies is a shield of arms, and down the stem are leaves similar to those at Buxtead.

BRACKET BRASSES.

Another kind of memorial is the bracket brass. In this case the figures are elevated on a bracket resting on a stem, as in examples from Upper Hardres, Kent, 1405; Bray, Bucks, 1370; and Southfleet, Kent, 1414. In the first named the figure of John Strete, dressed in a loose-fitting cassock and wearing a small skull-cap, kneels at the foot; a scroll issues from the hands addressed to the figures on the bracket, which represent St. Peter and St. Paul, with books and the usual emblems. The other two examples are somewhat similar, the figures in both instances stand on the bracket, which is supported by a stem, which in the Bray example rests on a fox.

METHODS OF RUBBING BRASSES.

A few words regarding the different ways of rubbing brasses. Before laying down the paper, dust the brass, as any dust prevents the heel-ball from taking an even colour. Stretch the paper over the brass, and keep it in position by means of weights or hassocks. In very long brasses, it is best to unroll the paper in short lengths. When brasses are on walls keep the paper in position by the aid of wafers, stamp-paper, mouth-glue, &c. Before commencing to rub, mark out the outline, and also press paper into the engraved lines, in order to bring them out sharp and clear; rub only one way, according to the main lines of the brass. If rubbed two ways the effect is blurred. Inscriptions should be rubbed downwards, as if rubbed crossways the edges of the letters come out thick. Wherever possible, take the rubbing clean by rubbing on a piece of paper laid over where the brass ends. Crockets, pinnacles, &c., may be rubbed on separate pieces of paper, which may afterwards be cut out and mounted on the rubbing. Shields of arms may be finished by using paper or colour. White marks caused by nails or blemishes may be stopped out with Indian ink or lamp-black. The white lines when not sharp enough may be touched up with Chinese white. Missing portions may be shown either by dotted lines or by rubbing off the corresponding portion. The best heel-ball for the purpose is made by Messrs. Ullathorne, Gate-street, Lincoln's Inn-fields, at 9d. and 1s. a piece. Paper, either 22½ or 30 in. wide, and not too thick, costs about 1s. for the former and 1s. 6d. for the latter size per piece. The 30-in. will be found wide enough for almost any brass. For brasses with double figures, the narrow kind is best, being more easily joined, as well as being more portable. Grey paper may be used for mounting the rubbing.

A metallic rubber used with black paper is also used for taking impressions, but I do not recommend it, as after a time the rubbing becomes indistinct. Blacklead and oil are sometimes used, but although good impressions may be obtained by this means, the operation has the disadvantage of being a dirty one. Blacklead used alone soon fades, but it may be rendered permanent by filling in the white lines with Indian ink.

A few words, in conclusion, both for and against brass rubbing. Try and exercise judgment in the selection of the specimens, or you will find yourself the possessor of a good deal of rubbish; an hour or two spent over a really fine brass in a good state of preservation is a more profitable employment than a longer time spent on inferior ones; and when you get them, if you try and learn something from them, either as to the vestments, armour, costume, heraldry, and even the alphabets shown in them, you will not find the subject so dry and uninteresting as it might at first sight appear.

[Some notes of the discussion which followed will be found elsewhere.]

OBITUARY.

Mr. J. C. Walker.—Mr. James Campbell Walker, architect, Edinburgh, died two or three days ago. Mr. Walker, who was born at Auchtermuchty in 1822, received his early training as an architect in the office of Messrs. Burn & Bryce, Edinburgh. On the removal of Mr. Burn to London, deceased went with him as one of his principal assistants. Later on he returned to Edinburgh, and acted as principal assistant in the office of the late Mr. David Bryce, R.S.A., for ten years. In 1857 Mr. Walker started practice on his own account, and was so well respected that his admirers presented him at that time with a sum of over 200*l.*, along with a set of silver instruments from his colleagues. His principal public works were:—Dunfermline Municipal Buildings, Hawick Town-hall and Municipal Buildings, Stonehaven County Buildings, Carnegie Public Library (Dunfermline), besides many asylums, poorhouses, and mansions.

Mr. Robert Herdman, R.S.A., the well-known Scottish painter, died suddenly on Tuesday evening in his studio. The *Times* says he was born at Rattray in 1830.

THE ARCHITECTURAL ASSOCIATION.

THE sixth meeting of this Association for the present session was held on the 6th inst., in the meeting-room of the Royal Institute of British Architects, Mr. John Slater, B.A. (President), in the chair.

Mr. T. E. Pryce (Hon. Sec.) read the proposed alterations in the rules to be submitted to the special business meeting on the 20th inst.

The Chairman said he had stated at the last meeting that the special business meeting would be held on the 20th inst., as Mr. Somers Clarke would then be prevented from reading his paper in consequence of his going abroad. Mr. Clarke had since intimated that he was not going abroad and would be happy to read his paper on the 20th. It was, therefore, decided to hold the special business meeting at 6·30 on that evening, before the reading of Mr. Clarke's paper.

The Chairman also announced the receipt of a letter from Colonel Edis, containing the following passage:—

"I am anxious to offer a prize of 10*l.* 10s., either in money or books, to the members of the Architectural Association, of which I have been a member for, I think, more than a quarter of a century. . . . . I would suggest that the prize should be devoted to some especial work of the younger students which may be of practical value, *not* the mere preparation of pretty sketches, but rather of some fair measured work, with practical and useful measured details, done in the ordinary holiday."

He was sure the members would agree that their hearty thanks were due to Colonel Edis for his very handsome offer. He felt great pleasure also in accepting it, because it endorsed the views he had more than once expressed as to the great desirability of looking not merely to draughtsmanship but rather to more practical work and measured detail. The matter had been referred to the Prize Committee, who would draw up a series of rules and regulations, which would be printed and submitted to the members in time to allow competition for the prize. A hearty vote of thanks was then passed to Colonel Edis for his gift.

Mr. W. Burrell (Hon. Librarian) announced several donations of books to the Library from Mr. R. Phené Spiers and others; also a donation of 5*l.* from Mr. Aldwinckle, to be expended for the benefit of the Library.

Mr. A. Oliver then read a paper on "Brasses of the Fourteenth and Fifteenth Centuries," which we print on another page. The paper was illustrated by a very fine collection of rubbings.

The Chairman having invited discussion upon the paper,

Mr. H. D. Appleton, in proposing a vote of thanks to Mr. Oliver, said they had seen that evening what really good and excellent results had been obtained by rubbing. He had been a very mild rubber himself, but he had never got anything like what they saw before them on the screens. He would like to ask Mr. Oliver whether he was cognisant of any good process for reproducing those things in books, not in a negative, but in a positive form, as the brasses themselves really looked. He had not been able to follow Mr. Oliver in his remarks on costume, but that was one of the things which should be very well studied by architects, as there could be nothing more interesting from a historical point of view than the costumes of the different periods. He did not know whether Mr. Oliver had seen any brasses of nuns. He remembered seeing an interesting monument in Romsey Abbey which he believed was that of the founder of the Abbey, the daughter of William Rufus, but, having broken her vows and married, she was shown with her hair escaping under her wimple.

Mr. C. C. Winmill seconded the vote of thanks to Mr. Oliver, and inquired whether he had ever used a yellow substance in rubbing instead of black heel-ball?

Mr. J. Neale, F.S.A., expressed his pleasure at seeing so many of the members present, and offered to give a prize of 20*l.* to the Association, the choice of subject to be left entirely to the committee (cheers). He would only suggest that his prize should not be given for hurried sketches, which would be useless, but either for properly measured drawings or finished sketches. He congratulated Mr. Oliver on the splendid collection of rubbings he had made, and considered it a good example of what could be done by industry. Besides costume and decorative ornament, there was a great deal in brasses that an architect could study with advantage.

The Chairman, in reply to Mr. Neale, stated that any decision come to by the committee with regard to his prize would be at once communicated to him.

Mr. Neale said he was quite ready to leave the matter in the hands of the Association.

Mr. A. C. Bulmer Booth remarked that there were four or five brasses in the Church of All Hallows, Barking, one a fine Flemish brass in the pavement of the nave. There was also a curious lead, let into the pavement under where the altar-table stood. It was said that the heart of Richard Cœur de Lion lay under it, but that, he believed, was a mere matter of tradition. Though not much of a rubber himself, he had done some rubbing at one time, and found it a most interesting work.

Mr. F. R. Farrow (Hon. Sec.) asked Mr. Oliver whether he was aware of any English examples of the *repoussé* brasses to be found on the Continent, such as those at Meissen? He agreed with what had been said as to the value of the study of brasses, not only with regard to costume, but also with respect to architecture and various other things. On the last excursion they met with very few brasses about Bath, but those they did find were extremely interesting specimens. Mr. Oliver appeared to have confined his attention to English brasses, but he (the speaker) remembered seeing one in Portugal very similar to the Delamere brass, and it was rather striking to find the same designs prevailing in different countries.

Mr. H. W. Pratt said that some years ago he used to be fond of rubbing on a blue-grey carton paper, which, though somewhat thick, had a very effective look, but was not quite so startling as the appearance of the white lines against the black. The rubbing of one of the brasses exhibited by Mr. Oliver showed some beautiful details, quite different from what were generally to be seen.

Mr. Edward D. Webb mentioned that in Wimborne Minster was to be seen the brass of King Ethelred, the only royal example, he believed, of the kind in England.

The Chairman said it was difficult to know which to praise most, Mr. Oliver's assiduity, or the skill with which he had carried out the several rubbings. For his own part, he should never have believed that Mr. Oliver could have got such beautifully sharp rubbings of the brasses. They could not but regret, too, the enormous amount of desecration and plunder that had been going on in regard to those brasses. A considerable part of the knowledge of vestments, both ecclesiastical and civil, as well as of knightly armour, had been derived from the brasses; and they would be quite sure that the persons who designed them had endeavoured to show, as well as they could in the material at their command, the actual garments

and style of dress in vogue at the time. He agreed, to a certain extent, with Mr. Neale, that brasses were valuable as showing architecture, but he could not help thinking that the designers of the brasses were more at home in the decorative portions of the work than in the purely architectural parts. Some of the canopies showed that the designers had permitted their imagination, to a certain extent, to run away with them, reminding one of what was to be seen on the walls of Pompeii, where architectural representations were used for mere decorative effect. But with regard to the interest attaching to the study of brasses, and the good to be obtained from rubbing and examining them, no two persons could have different opinions.

The vote of thanks was then put, and was very cordially received.

Mr. Oliver replied, and said he had not had much experience of the reproduction of rubbings so as to avoid the appearance of a negative. The *Builder* would reproduce two or three to accompany his paper.* A rubbing on on one of the screens was from a nun's brass. He had not mentioned the Flemish brass in the Church of All Hallows, Barking, as it was a sixteenth-century example. The lead referred to was doubtless the filling-up of the old matrix, the brass of which had been lost. He was not aware whether there were any examples of *repoussé* brasses. The date of the brass of Ethelred was 1400, and the inscription 1600.

A vote of thanks was passed by acclamation to Mr. Neale for his generous offer, and the proceedings terminated.

THE SPHERE IN PERSPECTIVE.

SIR,—Although, ere this reaches you, you will doubtless have received similar communications, it occurs to me to say that your objection (p. 836, Dec. 17, 1887) against the "distortionist" method of drawing a sphere in perspective as an ellipsoid is perfectly justifiable.

From whatever point of view is taken, the eye, in conveying a definite impression of the sphere to the brain, looks directly at it, and consequently sees as its outline that great circle which is perpendicular to the axis of vision. In other words, the section of the sphere, from the point of sight, is always a section of a right cone parallel to the base.

Mr. Phené Spiers's demonstration is perfectly correct, as a matter of descriptive geometry, but inaccurate as a matter of fact.

C. FRANCIS OSBORNE.

Department of Architecture,
Cornell University, Ithaca, N. Y.
December 29th, 1887.

ACCOUNT-KEEPING FOR ARCHITECTS AND SURVEYORS.

SIR,—Being in want of a short concise method of keeping accounts for an architect and surveyor's office, I should feel much obliged if you or any of your readers could inform me of any good short system.

A SUBSCRIBER.

Raffety, Thornton, & Co. (Limited).—The Directors of Raffety, Thornton, & Co. (Limited) will, at the general meeting of shareholders on the 31st inst., recommend the payment of a dividend at the rate of seven per cent. per annum (free of income-tax) for the half year ended 31st December, 1887, making seven per cent. for the year, writing 2,500*l.* off the goodwill account, and carrying forward 1,184*l.*

Rolled Iron Joists, &c.—Messrs. Measures Bros. & Co., of Southwark-street, have sent us a very useful calendar and illustrated section-sheet combined. The sections are figured with weights, spans, and safe-loads of rolled joists, built-up girders, fireproof flooring, &c.; and further useful information as to roofs, columns, and other ironwork is given. The whole thing folds very compactly, so that it can be readily carried in the pocket.

* See plate in this number. These reproductions, of course, necessarily give the black and white effect of the rubbings from which they are taken. In cases where there is much elaborate detail in the brass, the white on black rubbing, especially when photographed down to a small scale, has a brilliant decorative effect; but we quite agree with the idea that it might be as well to try a system of rubbing which would represent the real effect instead of its "negative." If white or yellow heel-ball can be made, why not try that on black paper, instead of black on white paper?—ED.

The Student's Column.

IRON.

II.—ORES.

IRON pyrites are not worked as an independent ore of iron, upon account of the great difficulty of separating all the sulphur from the metal. In calcining large masses of ore, containing small quantities of iron pyrites, the sulphur is carried off by the oxygen of the air in the shape of sulphurous acid gas. Pure carbonate of iron constitutes the ore known as Spathic ore, some specimens having the same crystalline form as calcareous spar (carbonate of lime). Spathic ore almost invariably contains manganese, which renders the iron more capable of being turned, or of being converted if required into steel. A small quantity is to be found in Somersetshire (Brendon Hills), but more of it in Durham (Weardale).

Clay ironstone is to be found in much greater abundance than any of the kinds we have already alluded to, but it does not give so much iron from the same amount of ore as the hæmatite class yield. The ores vary considerably in quality, ranging from 17 to 50 per cent. in their yield of iron. When containing less than 17 per cent. of iron they do not pay to work. The ores contain not only clay, but iron pyrites giving sulphur, and phosphate of iron giving phosphorus. The bulk of iron in this country is, however, obtained from clay ironstone, as it exists in the immediate neighbourhood of coal limestones, which are found useful in smelting the ore. These argillaceous (*argilla*, the Latin for clay) iron ores are not confined to the carboniferous rocks, but are met with in the lias, oolite, Wealden and tertiary strata, and occur in great abundance around Dudley in Staffordshire, in Yorkshire, Derbyshire, and in South Wales. Blackband is an ore discovered in Scotland in 1801. It differs from clay ironstone only in the amount of bituminous and carbonaceous matter which it contains. The presence of so much combustible material greatly facilitates the smelting, rendering the ore capable of being burnt in heaps without any additional fuel. Lanarkshire and Ayrshire contain extensive deposits, where the ore yields about 40 per cent. of iron. The yield from ores in this country is much less.

The first process to which iron ores have to be subjected in their preparation for manufacturing purposes is called smelting. For this purpose a large upright furnace lined with firebrick, known as the blast furnace, is necessary, into which air is forced from beneath by steam-power through three or more blast pipes, the ordinary ascending current of air produced by the draught of a chimney being insufficient. The blast pipes are so arranged that each stream of air takes its own course, and does not interfere with the other streams.

When the air is supplied to the furnace at its ordinary temperature it is spoken of as a cold blast furnace. This was the universal practice in former years, and the resulting material was known as "cold blast iron." It was for some time considered advisable to adopt a means of previous calcination so as to drive off the moisture as well as the carbonic acid, and thus save heat in the furnace. The raw ore was first dressed and sometimes washed, then broken up into masses, and afterwards roasted in heaps or kilns, by which process the porosity of the ore was increased. This was considered to be of great advantage, under the old system, to assist its reduction in the blast furnace.

The peroxide of iron is known to be a far weaker base than the protoxide of iron. In the process of roasting, the oxygen of the air combines with the protoxide of iron contained in the ore, and converts it into a sesquioxide of iron. It is thus rendered less liable to scorify, and less liable to waste in the slag, having a less liability to combine with the silica in the ore. Since, however, the introduction of the hot blast system, about fifty years ago, calcination has been much less practised.

Lifts.—The American Elevator Company have been instructed to proceed with the construction of eighteen elevators (six passenger and twelve luggage) for the new Whitehall Court, Thames Embankment, of which Messrs. Archer & Green are the architects; and also with six passenger elevators for the Savoy Mansions, Thames Embankment.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

777, Portable Wooden Houses. N. Leroy. (Belgium.)

According to this invention, the houses generally consist of a ground-floor and a loft. The ground floor is variously divided by means of partitions. The house is placed upon pillars of masonry,—an arrangement which allows the free circulation of air around the boards of which it is composed. Pine is, by preference, employed, being both light and cheap. The parts are connected by ordinary scarfed joints, and the structure is easily removable for wagon transport.

909, Ventilators. J. Jeffreys.

This is an invention for introducing pure air to buildings of all kinds, and by it the uncleansed air is made to pass through diaphragms or screens of suitable material, kept constantly wetted by capillary attraction effected by the lower end of each diaphragm or screen being immersed in suitable liquid. The diaphragms are not woven, but consist of single strands fixed close together in the direction of the tube, and held in position on the wires by a clip at top and bottom.

1,448, Chimney Cowl or Ventilator. J. Bidder.

To prevent down-draught, and to induce a strong up-current of air in the chimney, a cylindrical metal or other cap is, according to this invention, fixed on the top of the chimney, closing the top, near which is made a series of vertical apertures. Over this is fixed a vane, which, when moved by the wind, actuates a fan, which alternately opens and closes the aperture, and draws up the smoke, ejecting it at the same time.

1,790, Sash-Fasteners. J. B. and E. B. Podmore.

The fasteners made according to this invention are automatic, being operated by the depression of the lower sash. When a bolt is pressed back into its guide, and held there by a stop catch, the lower sash is liberated, and may be raised to any desired height. On drawing down the sash a small plate fixed thereon strikes upon and depresses the stop-bolt. The locking-bolt is then liberated, and being urged forward by its spring snaps over the said plate and prevents the rising of the sash. The fastening of the sashes is thus automatically effected.

3,630, Ladders. T. Jones.

According to this invention the ladders are made with wood or iron sides, with metal tubes for the rounds instead of solid rods. Holes are bored through the sides, then the ends of the rounds are inserted. The ends of the rounds are split open and a pin driven through the side of the ladder and fastened with wire.

14,405, Fire-grates. J. G. Cathie.

The fire-grate which is the subject of this patent has a perforated or reticulated tray or receptacle supported on guides or runners beneath the grating to catch the cinders and dust. The tray is shaken, when the ashes and dust fall through, leaving the partially-burnt cinders to be used again.

NEW APPLICATIONS FOR PATENTS.

Dec. 30.—17,919, D. Heys, Balancing Weights for Windows, doors, &c.—17,924, R. Grocott, Mounts for Door-knobs.—17,929, H. and T. Carter, Ventilating and Heating Halls, Rooms, &c.—17,933, R. Garner, D or Gully Trap.—17,954, J. Worth, Cranes and Hoists.

Dec. 31.—17,967, B. Gregory, Blue Bricks, Tiles, and Fire-bricks.—17,968, W. Wilson, Cowl and Ventilator.—17,981, D. and A. Burrow, Whitewashing and plastering brushes.—17,993, J. Winterflood, Chimney and Ventilating Cowls.—18,029, J. McKean, Machinery for Boring and Tunnelling Rock, Stone, &c.

Jan. 2.—22, C. Groombridge and J. Rickman, Lock-bolt, or Latch for doors, gates, &c.—25, J. Edelboum, Double Ventilator.—29, J. Barnard, Slow Combustion Stoves.

Jan. 3.—77, J. Wiles, Localising Fire and Preventing Panic in case of fire in Theatres and other Public Buildings.—94, H. Haddan, Lock Fastenings.—95, A. Von Csòka, Protection of Windows and other openings by bars, &c.

Jan. 4.—132, J. Robins, Excavator for Tunnelling.—136, F. Weber, Heating and Ventilating.—154, E. Cadè, Heating Apparatus.

Jan. 5.—182, A. Nicholas, Door and Till Bell-striking plates.—185, A. Clifford, Extinguishing Fires in Theatres, &c.—194, W. Fraser, Automatic Closing Speaking-tube Mouth-piece. — 204, G. Asher, Preventing the Clattering and Shaking of Windows.

PROVISIONAL SPECIFICATIONS ACCEPTED.

15,475, T. Letheren, Silent Water Waste Preventer Cistern.—15,969, B. Healey, Outlet Valves for Sewer Flushing Tanks, &c.—16,389, A. Ellis, Joining Soft Metal Pipes.—16,397, J. Pollock, Attaching Door Knobs, &c., to Spindles.—16,932, J. Kenyon and Others, Hand Trucks.—16,976, S. Jones and R. Roberts, Tenoning and Mortising Machines. — 17,005, H. Steven and J. Walker,

Domestic Fire Grates.—17,176, T. Harrison, Burglar Alarms.—17,281, S. Tuddenham Ornamentation of Art Metal Work by the use of Glass Globes or Balls.—17,285, H. Hancock, Curing Smoky Chimneys.—17,396, R. Dickenson, Slow Combustion Stove Grates.—17,420, J. Peacocke, Portable Hut.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

1,811, W. Thompson, Warming and Ventilating Schools and Buildings.—2,848, W. Kimberley, Plough and Sash Fillister Planes.—3,220, H. Wethered, Regulator for Water-Closets.—3,269, J. Ellis and J. Trippett, Preventing the Ingress or Egress of Draughts, Dust, and Wet, through the Bottoms or other Parts of Doors.—3,349, J. Ebner, Parquet and other Floorings.—3,470, W. Moore, Preventing Waste-Pipes from Bursting.—3,568, G. Girling, Artificial Stone.—3,789, H. Hunt, Register and other Fire Grates.—3,916, T. Williamson, Saw Sets.—4,818, S. Taylor, Metal Covered Roofs.—16,796, H. Lake, Devices for Preventing the Slamming of Doors.—16,804, A. Boult, Flushing Cisterns.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

JANUARY 2.

By BULLOCK & SADLER.

Shepherd's Bush—286, Goldhawk-road, 50 years, ground-rent 6*l*. £415

JANUARY 5.

By HERRING, SON, & DAW.

Finsbury—57 and 59, Clifton-street, 19 years, ground-rent 13*l*. 12s. 560

61 and 63, Clifton-street, 19 years, ground-rent 13*l*. 12s. 730

14, Finsbury-market, 18 years, ground-rent 5*l*. 2s. 300

MEETINGS.

MONDAY, JANUARY 16.

Royal Institute of British Architects.—Special General Meeting to announce the awards of Medals and Prizes, 8 p.m.

Leeds and Yorkshire Architectural Society.—Rev. Canon Scott on "The Transitional Periods of Gothic Architecture." 7·30 p.m.

Victoria Institute.—8 p.m.

TUESDAY, JANUARY 17.

Statistical Society.—Mr. B. Jones on "Progress, Organisation, and Aims of Working-Class Co-operators." 7·45 p.m.

Institution of Civil Engineers.—(1) Further discussion on the late Mr. Hamilton Goodall's paper on "The Use and Testing of Open-hearth Steel for Boiler-making." (2) Sir Bradford Leslie, K.C.I.E., on "The Erection of the 'Jubilee' Bridge over the River Hooghly, on the Line of the East Indian Railway." 8 p.m.

WEDNESDAY, JANUARY 18.

British Archæological Association.—(1) The Rev. Canon Collier, F.S.A., on "Recent Discoveries in Winchester Cathedral. (2) "Notes on Ancient Roads," by Mr. Geo. Payne, F.S.A. 8 p.m.

Royal Meteorological Society.—Address by the President (Mr. W. Ellis). 8 p.m.

Society of Arts.—8 p.m.

Builders' Foremen and Clerks of Works' Institution.—Annual Meeting. 8·30 p.m.

THURSDAY, JANUARY 19.

Royal Institution.—Mr. H. Herkomer, A.R.A., on "The Walker School." 3 p.m.

Society of Antiquaries.—8.30 p.m.

FRIDAY, JANUARY 20.

Architectural Association.—(1) Special Business Meeting to consider proposed alterations of Rules. 6.30 p.m. (2) Mr. Somers Clarke, F.S.A., on "The Use and Abuse of Materials." 7·30 p.m.

Miscellanea.

Preferential Railway Rates on Foreign Produce.—The ordinary monthly meeting of the Council of the Railway and Canal Traders' Association was held on the 4th inst. at the offices of that body, Eastcheap-buildings, Eastcheap, Mr. James Duncan in the chair. Among those present were the Hon. F. Strutt, Mr. W. E. M. Tomlinson, M.P., Mr. B. Buss, Mr. H. Sharpley, Mr. R. J. Sankey, Mr. W. W. Blackstone, Mr. D. M'Naughton, Mr. H. J. Fischel, and Mr. Edwin Clements, secretary. Several new members were elected, and the secretary reported that the average number of complaints as to excessive and unfair railway rates had been exceeded during the previous month. The subjects for consideration included the future of canals, the Birmingham and Humber Navigation Bill, railway rates on fish, the forthcoming Railway Bill, and foreign preference. With regard to the latter subject, the following resolution was unanimously adopted:—

"That in view of the provisions contained in the Government Railway Bills of 1886 and 1887 with respect to preferential railway rates in favour of foreign produce, it is urgent that a test case involving this point be fought, and that steps be at once taken to raise a special fund for the purpose of insuring the imitation of proceedings prior to the introduction of the promised Railway Bill in the next Session, and their due prosecution subsequently."

Messrs. W. & R. Leggott, of Bradford, have opened offices at 235, High Holborn, W.C.

The Sanitation of Florence.—The *Lancet* of the 7th inst., in a special article on Florence, points out that though the town now possesses a pure water supply, this is not distributed in all the streets. Even where obtainable, landlords still often fail to avail themselves of this advantage, and allow their tenants to drink water taken from private wells placed in dangerous proximity to cesspools. The drainage of Florence is far from perfect. Some of the public sewers, of which sketches are given, have insufficient fall and flat inverts, with many angles, which naturally cause much friction, and consequently the deposition of the heavier contents of the sewage. There is no by-law in force regulating the construction of house-drains, which consequently remain untrapped and unventilated. It is therefore urged that intending visitors should refuse to rent apartments unless a written guarantee is given that nothing but the town water supply shall be provided. English public opinion, which has considerable influence in Florence, should also be brought to bear so as to urge upon the authorities the necessity of at once laying down pipes in all the streets where the new water supply is not yet provided. Wherever the town supply exists, the old well ought to be closed. Then a system of house-to-house visitations should be instituted, and by-laws enacted to ensure the compulsory trapping of all drain-pipes. At present the ordinary closets consist of a marble seat with no valve to the pan. This leads to a 9-in. earthenware pipe of very inferior quality, which is generally surrounded by rough masonry. There is no water or trap, and the pipe goes straight down to the cesspool, of which it serves as the principal ventilator. In course of time the earthenware pipe breaks away, and then there remains but the rough and porous masonry, to which the soil adheres, infecting the surrounding walls. From these closets foul gases, without let or hindrance, have access into the apartments. Of course, in certain houses, hotels, and boarding-houses, English water-closets have been introduced; but they are the exception. These contrivances do not govern the health of Florence, which still suffers from a very high death-rate, though they may be useful in saving a few individual visitors.

Manchester Architectural Association.—The last ordinary meeting of this Association was held at the Diocesan Buildings on the 10th inst., Mr. A. H. Davies Colley (President) in the chair. Mr. C. Heathcote, F.R.I.B.A., read a paper on "Faïence," or a visit to Burmantofts Pottery Works, Leeds. He commenced by defining the terms "terra-cotta," "brick," and "faïence," and described the necessary chemical qualities of the clay to produce the best work. The clay is found at a depth of 60 or 100 yards from the surface in a hard rock-like condition,—blasting being necessary in the mining operations. The clay on coming from the shaft is run into large steel perforated revolving pans, in which it is crushed under heavy rollers. When sufficiently fine it is mixed with water, and a necessary degree of plasticity imparted; the clay is then stored in a damp cellar to become "mellow," after which it is ready for moulding. The painting is done before the firing, but the colours when first put on bear no relation to those actually required. The surface is then glazed, and the whole mass burnt in a furnace. A vote of thanks was proposed by Mr. J. S. Hodgson, seconded by Mr. J. H. Woodhouse, and supported by Mr. Mould and the Chairman.

Society of Arts.—Before Easter there will be three courses of Cantor Lectures at the Society of Arts:—Four lectures on "Yeast: its Morphology and Culture," by A. Gordon Salamon, F.I.C., F.C.S.; two lectures on "The Modern Microscope," by John Mayall, jun.; three lectures on "Alloys," by Professor Chandler Roberts-Austen, F.R.S. The course of two lectures to be delivered as a memorial of the late Dr. Mann will be given by Professor Oliver J. Lodge, F.R.S., the subject being the "Protection of Buildings from Lightning." There will also be a course of three lectures on "Etching and Mezzotint Engraving," by Prof. Hubert Herkomer, A.R.A.

Sewage Disposal at Watford.—The Watford Local Board have lately acquired some 100 acres of land for the disposal of their sewage upon the system of broad irrigation. An arrangement of outfall works, designed by Mr. Urban Smith, C.E., of Westminster, has been adopted by the board, and the works are shortly to be carried out.

The Price of Lead, Zinc, Tin, and Copper.—Messrs. G. Farmiloe & Sons, in a circular issued on the 2nd inst., say:—

"We have to note a recent considerable rise in the values of many articles in which we deal, more particularly in the case of metals. This advance has undoubtedly been materially helped by speculation, but at the same time we think it would be unwise to ignore the improvement in trade which has lately been apparent in many of the leading industries of the country, and the more hopeful prospects of trade in the immediate future. With this preface we beg to note the present position of the markets:—

Lead.—Steady market, at an advance of about 3*l*. per ton from the lowest. We hesitate to express an opinion on the future of this market, but it is said the statistical position is better than for some time past, and that present values will probably be maintained.

White Lead.—Prices are also about 3*l*. per ton higher, and seem likely to remain firm for some time, owing to the custom of manufacturers to sell their production several months in advance; our information leads us to believe that contracts have, as usual, been largely entered into, extending over the early months of the year.

Zinc.—Manufacturers' present prices show an advance of about 6*l*. per ton; the strength of the market appears to be in the short supply of the raw article, viz., spelter, which is largely in demand for galvanising purposes, this trade being particularly active.

Tin and Solders.—The tin market has been practically in the hands of a syndicate for the last three months, with the result that prices have been rapidly driven up about 60 per cent.! This article is at present firmly held at the advanced price. Solder prices are proportionately dearer.

Copper.—Although our interest in this market is but slight, the advance in price being so considerable as 100 per cent. we think best to notify it as being another index to the general tendency of prices at the present time, and also as bearing on

Plumbers' Brass Work, which has been sensibly affected by the increased value of copper, prices having advanced about 10 per cent."

Royal Victoria Hospital, Montreal.—ABoard of Governors, with the Hon. J. J. C. Abbott, Q.C., as President, has been organised, under a charter obtained during the last session of the Dominion Parliament of Canada, for the constitution of the Royal Victoria Hospital, about to be erected for the city of Montreal through the munificence of Sir George Stephen, Bart., President and Director of the Canadian Pacific Railway, and Sir Donald Smith, K.C.M.G., M.P., also a director of the same railway. These gentlemen have given one million dollars for the purposes of the foundation of the Institution, and the Corporation of the city has very generously supplemented the gift by granting as a site for the new building a lease in perpetuity of a plot of land about 12 acres in extent, situated near to the north-east angle of Mount Royal Park, at an elevation of about 300 ft. above the St. Lawrence river, towards which the city gradually slopes. It is proposed that the establishment shall accommodate about 300 patients, and that in addition to the ordinary requirements of a hospital of that extent there shall be a training school for nurses, a medical school, and an out-patients' department. Mr. H. Saxon Snell, F.R.I.B.A., of London, has been requested by the Board of Governors to prepare a design and direct the construction of the building.

East India Teak.—Messrs. C. Leary & Co., in their annual circular, say:—"The statistics for the last three years are:—

	1887. Loads.		1886. Loads.		1885. Loads.	
	Tmbr.	Plnks.	Tmbr.	Plnks.	Tmbr.	Plnks.
Imports	7,007	1,205	16,330	2,181	8,195	2,453
Deliveries	9,902	2,125	8,889	2,022	9,078	1,886
Stock, Dec. 31..	10,001	766	12,896	1,686	5,497	1,689

The present stock of timber is composed of 6,950 loads Moulmein, 1,163 loads Rangoon, and 1,888 loads Bangkok. Consequent on the revival of the shipbuilding industry, the year closes with a decided improvement in the market both in tone and values, and the immediate prospects are much brighter than for some time past. The present stock of timber and plank showing a reduction of as much as 26 per cent. on that held at the corresponding period of last year, and stocks in other markets having also been considerably reduced, we certainly ought to see much better prices, notwithstanding that there are now 6,829 tons afloat, with 22,893 tons chartered to load, against 5,395 tons afloat, with 11,329 tons under charter, on the 1st of January, 1887. We quote Burmah at 11*l*. per load, Siam ruling at from 9*l*. 10s. to 10*l*. per load."

University College, Bristol.—The lectures for the engineering courses, mechanical, electrical, and civil re-commence on Monday, January 16th. The subjects of applied mechanics, strength of materials, kinematics of machinery, and current electricity will be treated during the ensuing term. Special facilities for entrance into works during the summer months are offered during this session.

The Price of Iron and Steel. — Messrs. Matheson & Grant, in their last half-yearly "Engineering Trades' Report," issued on the 2nd inst., say that the sudden and great rise during the last three months in the prices of copper, tin, and other metals gave the stimulus which alone was wanting to an advance in the values of iron and steel, which had continued to fall after the issue of their July report. This advance has been supported by a genuine growing demand, as well as by the speculative dealings of those anticipating a further rise, but the large stocks of pig iron, and the producing capacity available render any but a slow movement unjustifiable. The quantity of pig iron manufactured at Cleveland in 1887 was less than in 1886, but the difference was more than made up by the increase in the quantity of basic pig or steel, made in the same locality. Rolled iron has for a considerable time been selling at prices hardly repaying the deterioration of the plant producing it, and the slight improvement in price is rather a reflection of that in steel, than due as yet to any increased demand. If, however, the consumption does grow, the reduction of late years in the number of puddling furnaces would now assist in an improvement of prices. High-class Yorkshire iron of the Farnley or Low Moor type suffers most from the rivalry of steel, and it is likely that the future of such iron will lie rather in the direction of bars for various smithing purposes, than as heretofore of plates for flanging and other severe treatment. Steel has risen in price, this being partly due to the advance in Cumberland and Spanish hæmatite ore (the latter because of higher freights from Bilbao), but in the case of plates and other structural material to the greater demand. The revival of the ship-building industry has had a direct and immediate effect, but it is yet to be seen how far the enormous productive power, now equal for plates alone to about 10,000 tons per week, will keep prices from advancing further. The rail trade has been only moderately active during the last six months; some large colonial and other orders have just been placed, but at present the prospects for the new year are not well assured. The hoped-for demand from the United States has been checked by the fall in prices there, where there is a combined action among rail-makers to meet European competition, notwithstanding the rise in prices in that country of all other engineering material. Nearly two millions of tons of steel rails have been made in America during the past year. An increase of exports seems likely from Great Britain to the Southern States and to the Pacific coast, where cheap ocean freights allow sea-borne rails to compete with American products.

Wrought-Iron Casements and Frames.—Messrs. Burt & Potts have sent us a proof of a new illustrated catalogue which they are issuing of their admirable wrought-iron casements and frames. The catalogue is well worth the attention of architects and builders, inasmuch as it shows the progress which has been made in iron casements of late years,—progress which is not generally known. The catalogue contains sections and other details of the casements and frames. These casements can now be made of any size, hung at the sides on brass hinges, made to open outwards or inwards, and prepared for the reception either of plate glass, lead lights, or sheet glass in any number of panes, and fitted with handles and stays of varied material and design. For lights above transoms, Messrs. Burt & Potts make what they guarantee to be water-tight and other windows and frames, hinged at top, to open outwards, with gun-metal jointed stays and fastenings, easily worked by means of a "long arm." Similar lights are also made to open and close by means of cords. To meet a demand for cheap but fairly good casements, Messrs. Burt & Potts have lately introduced a wrought-iron casement frame, of a new section, of solid rolled iron, suitable for schools, cottages, &c. The catalogue has an appendix, containing a number of testimonials from eminent architects, who, having used these casements, speak in very high terms of them.

Scotch Church, Liverpool.—The managers of the Scotch Church, Oldham-street, Liverpool, are erecting new vestries, in place of those recently destroyed by fire a few months back, from designs supplied by Messrs. Mercer & Allender, architects, of that city. The contractors for the work are Messrs. Holme & Green, also of that city.

Discovery of Marble in Norway.—A marble deposit has been discovered in the Saltenfjord, in the province of Nordland. The discovery of the real nature of the deposit was made by an English geologist accidentally becoming possessed of some samples of the stone, and this has led to a thorough investigation of the site. The architect of the Throndhjem Cathedral, Herr Christie, has despatched an expert to the deposit, who reports that the marble is of such a fine quality and so regularly striped, that it may be used in restoring that edifice. Other experts have also visited the deposit. The marble is found in large strata, and varies in colour from a close, finely-grained stone of pure white, to a yellow, green, orange, grey, and even black, whilst one stratum is black with white crystallised veins. An offer has already been received from England for the whole deposit, but the owners prefer forming a native company for working it. It should be mentioned that the deposit is situated close to the shore, and in a fjord open all the year round, whilst it is only some forty-eight hours' steam distant from this country.

Kew Church.—Referring to our illustrations and notice of Kew Church in the *Builder* of December 31st (p. 929), we are asked by Messrs. Bellman & Ivey to say that the columns in the chancel, which are prominently shown in one of the illustrations, are of scagliola, and were made by them, with specially modelled capitals, &c., under the superintendence of Mr. H. Stock, the architect.

Sewage Works at Bacup.—The Bacup Town Council, at their last monthly meeting, purchased 12,460 square yards of land for 1,910*l.*, upon which to construct tanks and other necessary buildings for dealing more efficiently with the sewage of the higher part of the Borough; they are also in treaty with the owners of land situate at Stacksteads for the disposal of the sewage of that part of the Borough; it is proposed to pump the sewage of the latter portion of the district through a rising main a little over a mile long to a height of 45 ft. The engineer for the schemes is Mr. John Wilson, C.E., the Borough Engineer.

PRICES CURRENT OF MATERIALS.

TIMBER.	£. s. d.	£. s. d.
Greenheart, B.G. ....ton	6 10 0	7 15 0
Teak, E.I. ....load	8 0 0	12 10 0
Sequoia, U.S. ....foot cube	0 2 3	0 3 0
Ash, Canada ....load	3 0 0	4 10 0
Birch ,, ...load	2 0 0	3 10 0
Elm ,, ...load	3 10 0	4 10 0
Fir, Dantsic, &c.	1 10 0	4 0 0
Oak ,, ...	2 10 0	4 10 0
Canada	3 0 0	6 0 0
Pine, Canada red	2 0 0	3 10 0
,, yellow	2 0 0	4 0 0
TIMBER (*continued*).	£. s. d.	£. s. d.
Lath, Dantsic ....fathom	3 0 0	5 0 0
St. Petersburg	4 0 0	5 10 0
Wainscot, Riga ....log	0 0 0	0 0 0
,, Odessa, crown....	2 10 0	3 0 0
Deals, Finland, 2nd and 1st...std.100	7 10 0	9 0 0
,, 4th and 3rd	6 0 0	8 0 0
Riga	5 10 0	7 10 0
St. Petersburg, 1st yellow	8 10 0	14 0 0
,, 2nd ,, ...	7 0 0	8 0 0
,, white	6 10 0	8 10 0
Swedish	8 15 0	15 0 0
White Sea	7 0 0	16 10 0
Canada, Pine, 1st	16 0 0	24 0 0
,, ,, 2nd....	10 0 0	15 10 0
,, ,, 3rd, &c....	7 0 0	9 10 0
,, Spruce, 1st	8 0 0	9 10 0
,, ,, 3rd and 2nd	5 0 0	7 0 0
New Brunswick, &c....	5 0 0	7 0 0
Battens, all kinds	4 0 0	10 10 0
Flooring Boards, sq., 1 in., prepared, First	0 8 0	0 11 6
Second	0 6 6	0 7 6
Other qualities	0 4 0	0 6 0
Cedar, Cuba ....foot	0 0 3½	0 0 3½
Honduras, &c.	0 0 3	0 0 3½
Australian	0 0 2	0 0 3
Mahogany, Cuba	0 0 4½	0 0 7
St. Domingo, cargo average	0 0 4½	0 0 6
Mexican ,, ...	0 0 3½	0 0 3½
Tobasco ,, ...	0 0 4	0 0 5
Honduras ,, ...	0 0 4	0 0 5
Maple, Bird's-eye	0 0 5	0 0 7
Rose, Rio ....ton	8 0 0	11 0 0
Bahia....	7 0 0	9 0 0
Box, Turkey	5 0 0	13 0 0
Satin, St. Domingo ....foot	0 0 5	0 0 9
Porto Rico	0 0 6	0 0 10
Walnut, Italian	0 0 4	0 0 5½
METALS.		
IRON—Bar, Welsh, in London...ton	0 0 0	0 0 0
,, ,, in Wales	0 0 0	0 0 0
,, Staffordshire, London	0 0 0	0 0 0
COPPER—		
British, cake and ingot ....ton	79 0 0	80 0 0
Best selected	82 0 0	83 0 0
Sheets, strong....	90 0 0	0 0 0
Chili, bars	86 0 0	0 0 0
YELLOW METAL....lb.	0 0 7½	0 0 8
LEAD—		
Pig, Spanish ....ton	15 0 0	0 0 0
English, common brands....	15 10 0	0 0 0
Sheet, English	16 5 0	16 10 0
SPELTER—		
Silesian, special ....ton	21 5 0	21 10 0
Ordinary brands....	21 0 0	21 5 0
TIN—		
Straits....ton	167 10 0	0 0 0
Australian	167 10 0	0 0 0
English ingots	0 0 0	0 0 0
OILS.		
Linseed ....ton	19 5 0	19 10 0
Cocoanut, Cochin	28 0 0	29 0 0
Ceylon	23 15 0	0 0 0
Palm, Lagos	21 10 0	0 0 0
Rapeseed, English pale	25 15 0	26 5 0
,, brown	24 5 0	0 0 0
Cottonseed, refined	19 10 0	0 0 0
Tallow and Oleine....	25 0 0	45 0 0
Lubricating, U.S....	5 0 0	6 0 0
,, refined....	5 0 0	12 0 0
TURPENTINE—		
American, in casks ....cwt.	1 8 0	0 0 0
TAR—		
Stockholm ....barrel	0 15 0	0 15 6
Archangel	0 10 0	0 10 6

COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
Chapel and Schools, Wigan	Building Committee.....	25*l.*	Feb. 7th	ii.
School Building	Leathersellers' Company	Not stated	Feb. 21st	x.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Works and Materials	Wandsworth Bd. of Wks	*Official*	Jan. 17th	ii.
Making-up Roads, &c....	Tottenhm L. B. of Health	J. E. Worth	do.	ii.
Underground Urinal, &c.	Greenwich Bd. of Wks.	*Official*	Jan. 18th	x.
Firewood	Hastings Union	do.	do.	x.
Hospital and Making-up Roads, &c.	Hornsey Local Board...	T. de Courcy Meade ...	Jan. 23rd	ii.
Water Supply Works	Honiton Corporation ...	R. E. Middleton	Jan. 24th	x.
Brick Sewers, &c.	West Ham Council.....	Lewis Angell	do.	x.
Chrysanthemum House, &c.	Met. Board of Works...	*Official*	do.	x.
Granite Spalls....	West Ham Union.....	do.	Jan. 25th	x.
Works and Materials	Hackney Board of Wks	J. Lovegrove....	do.	x.
Road-Making and Paving Works	Fulham Vestry.....	*Official*	do.	x.
Alterations and Additions to Workhouse	Durham Union.....	W. Crozier, Jun.....	Jan. 27th	x.
Iron Bridge, Flood Prevention Works	Canterbury Cor.	Hall & Jennings	Jan. 30th	x.
Forming and Making-up Roads, &c.	Beckenham Local Brd.	G. B. Carlton	Feb. 6th	x.
Construction of Aqueduct	Manchester Cor. Wtrwks	G. H. Hill	Feb. 14th	ii.
Works and Repairs to Public Buildings.....	Com. of H.M. Works...	*Official*	Feb. 16th	x.
Hospital Infirmary	Belper Union.....	C. O. Ellison & Son.....	Not stated...	ii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Inspector of Highways....	Reading Corporation ...	2*l.* weekly	Jan. 24th	xiv.

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *Noon on Thursdays.*]

BANBURY. — For alterations, &c., to George and Dragon stables, for Messrs. P. Phipps & Co. (Limited), Northampton. Messrs. J. Ingman & Son, surveyors, Northampton :—

Harding	£265 10 0
Kimberley	240 0 0
Page	228 0 0
Jarvis	225 0 0
Orchard & Son	219 0 0
Chas. Claridge, 1, Warwick-road, Banbury (accepted)	215 0 0

BERMONDSEY.—For new plumbing and drainage works at Parish-street Workhouse, for the Guardians of St. Olave's Union. Messrs. Newman & Newman, architects and surveyors, 31, Tooley-street, London Bridge :—

Bellchambers, & Son	£726 10 0
W. F. Russell	680 0 0
Smith & Barnes	680 0 0
White & Co.	578 0 0
J. & J. Greenwood	570 0 0
J. Bullers	550 0 0
W. H. Pritchard	543 0 0
H. Hart	537 0 0
W. & H. Castle (accepted)	530 0 0

BERMONDSEY. — For making screens and laying wood block floors, &c., at Tanner-street Workhouse, for the Guardians of St. Olave's Union. Messrs. Newman & Newman, architects and surveyors, 31, Tooley-street, London Bridge :—

Spencer & Co.	£404 11 8
Bellchambers & Son	398 0 0
J. Riches	396 0 0
J. & J. Greenwood	335 0 0
J. Bullers	320 0 0
Smith & Barnes	315 0 0
H. Hart	314 0 0
J. Almond	309 0 0
W. H. Castle	307 0 0
A. White & Co.	290 0 0
W. F. Russell	289 0 0
W. H. Pritchard (accepted)	265 0 0

BERMONDSEY. — For forming four cubicles for married people at Parish-street Workhouse, for the Guardians of St. Olave's Union. Messrs. Newman & Newman, architects and surveyors, 31, Tooley-street, London Bridge :—

Spencer & Co.	£134 5 6
Bellchambers & Son	125 0 0
J. Riches	122 10 0
A. White & Co.	116 0 0
H. Hart	110 0 0
J. & J. Greenwood	105 0 0
W. & H. Castle	102 0 0
J. Bullers	98 0 0
W. H. Pritchard	96 10 0
Smith & Barnes	95 0 0
W. F. Russell	79 0 0
J. Almond (accepted)	70 10 0

BEXHILL-ON-SEA.—For the erection of villa residence, Bexhill-on-Sea, for Dr. J. P. Wills. Mr. M. J. Lansdell, architect, Hastings :—

Ockendon	£1,797 0 0
Parker	1,449 0 0
Hughes	1,393 0 0
Warman	1,379 0 0
Phillips	1,365 0 0
King	1,357 0 0
Snow	1,353 0 0
Jenkins	1,260 0 0

BLACKHEATH.—For alterations and additions to No. 10, Paragon, for Mr. A. Cator. Mr. R. W. Collier, architect, 30, Lincoln's Inn-fields :—

Gates	£1,336 0 0
Read	979 0 0
Jerrard	879 0 0
Havell	792 0 0

HARROW.—For the erection of 150 yards concrete shooting tunnel, for Messrs. Cogswell & Harrison, gun and rifle manufacturers. Mr. Christopher M. Shiner, architect :—

G. Potter	£269 0 0
H. Drury (accepted)	268 8 10

LONDON.—For alterations and repairs to house and stables, Gloucester-place, W., for Mr. Blount. Mr. L. A. Shuffrey, architect :—

J. Chapman, Hackney	£1,048 12 0

[No competition.]

LEEDS. — For lecture-hall and Sunday schools to Belgrave Chapel, Leeds. Mr. E. Dodgshun, 1, East Parade, Leeds, and Mr. W. H. Thorp, A.R.I.B.A., 25, Albion-street, Leeds, joint-architects :—

Bricklayer and Mason.	
W. Thompson & Sons, Leeds	£784 3 0
Carpenter and Joiner.	
James Taylor, Yeadon	460 0 0
Plumber and Glazier.	
Geo. Lazenby, Leeds	105 10 0
Slater.	
A. W. Cockersole, Leeds	50 10 0
Plasterer.	
J. Dixon Dakin, Leeds	54 0 0
Painter.	
W. Walker, Leeds	21 10 0
Hot-water Engineer.	
E. Oldroyd, Leeds	45 0 0
[All accepted.]	£1,520 13 0

LONDON.—For alterations and additions to No. 77, Lancaster Gate. Mr. W. Jacomb Gibbon, architect, 36, Great James-street :—

T. L. Green	£1,633 0 0
E. L. Nunn	1,515 0 0
Oldrey & Co.	1,450 0 0
Head & Son	1,365 0 0
Gibbin & Son	1,195 0 0
Macfarlane Bros. (accepted)	1,035 0 0

LONDON.—For alterations and additions to No. 45, Cleveland-square. Mr. W. Jacomb Gibbon, architect, 36, Great James-street —

T. L. Green	£868 0 0
Macfarlane Bros.	818 0 0
Head & Son	740 0 0
E. L. Nunn	495 0 0
Gibbon & Son (accepted)	494 10 0

LONDON. — For erecting three warehouses, Eden-street, Hampstead-road. Mr. J. Waghorn, architect :—

J. Watson	£5,485 0 0
Kirk & Randall	5,398 0 0
Laing & Son	5,296 0 0
R. Perkins	5,177 0 0

LUTON.—For the erection of new shop and premises, Manchester-street, for Mr. Wm. Bigg. Mr. W. J. Pearson, architect, Market-hill. Quantities not supplied :

Smart	£785 0 0
Parkins	778 0 0
Dunham	768 0 0
Neville Bros.	760 0 0
Ford	750 0 0
Wright *	749 0 0

[All of Luton.]

* Accepted subject to slight deductions.

OXFORD.—For the reconstruction of the drainage and sanitary arrangements of Frewen Hall, for Brasenose College. Messrs. Best & Son, M.Ms. Inst. C.E., 18, Abingdon-street, Westminster, engineers :—

Symm & Co.	£221 0 0
Knowles & Son	208 4 0
Wyatt & Son	190 0 0
Chas. Curtis (accepted)	180 0 0

[All of Oxford.]

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